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Research Document 2001/095 | **Document de recherche 2001/095**

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Ocean Activities and Ecosystem Issues on the Eastern Scotian Shelf: An Assessment of Current Capabilities to Address Ecosystem Objectives*

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Keywords: multiple ocean use, ecosystem objectives, cumulative ecosystem effects, ocean governance

* The views expressed in this paper do not necessarily reflect the policy of Fisheries and Oceans Canada.

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This document is available on the Internet at: http://www.dfo-mpo.gc.ca/csas/

Ce document est disponible sur l'Internet à:

ISSN 1480-4883
Ottawa, 2001

Canada

Abstract

Conservation and environmental protection objectives and regulatory measures for key ocean use sectors (fisheries, oil and gas, marine transportation, maritime defence operations, and potential ocean mining) on the eastern Scotian Shelf area are examined. These ocean sectors are analyzed to determine the extent to which proposed new ecosystem objectives are considered in current management planning. Existing management plans and measures were not expected to have explicit references to all of the proposed ecosystem objectives. The capabilities and effectiveness of current governance/institutional structures are assessed, and changes required for addressing defined ecosystem objectives are identified, for each ocean use sector. In addition to sector-specific considerations, the paper addresses the issues of cumulative ecosystem effects and makes recommendations for changes and additions to governance structures to ensure that ecosystem objectives are met in the eastern Scotian Shelf area.

Résumé

Le document se penche sur les objectifs et les mesures de réglementation en matière de conservation et de protection environnementale visant les principaux secteurs qui font usage des ressources des océans (pêches, hydrocarbures, transport maritime, opérations de défense maritime et exploitation minière sous-marine potentielle) dans l'est du plateau néo-écossais. Ces secteurs d'exploitation sont analysés afin de déterminer la mesure dans laquelle les nouveaux objectifs proposés en matière d'écosystèmes sont pris en considération dans les activités actuelles de planification de gestion. Nous ne nous attendions pas à ce que les plans et les mesures de gestion actuels citent de façon explicite tous les objectifs proposés pour les écosystèmes. Nous avons plutôt évalué les capacités et l'efficacité des structures actuelles d'intendance/institutionnelles, et nous avons identifié les changements nécessaires pour que soient pris en considération les objectifs définis des écosystèmes dans chaque secteur d'utilisation des ressources des océans. En plus des considérations propres aux secteurs, le document aborde les questions des effets cumulatifs des activités d'exploitation sur les écosystèmes, et recommande des changements et des ajouts aux structures d'intendance qui permettront de voir à ce que les objectifs relatifs aux écosystèmes soient atteints dans l'est du plateau néo-écossais.

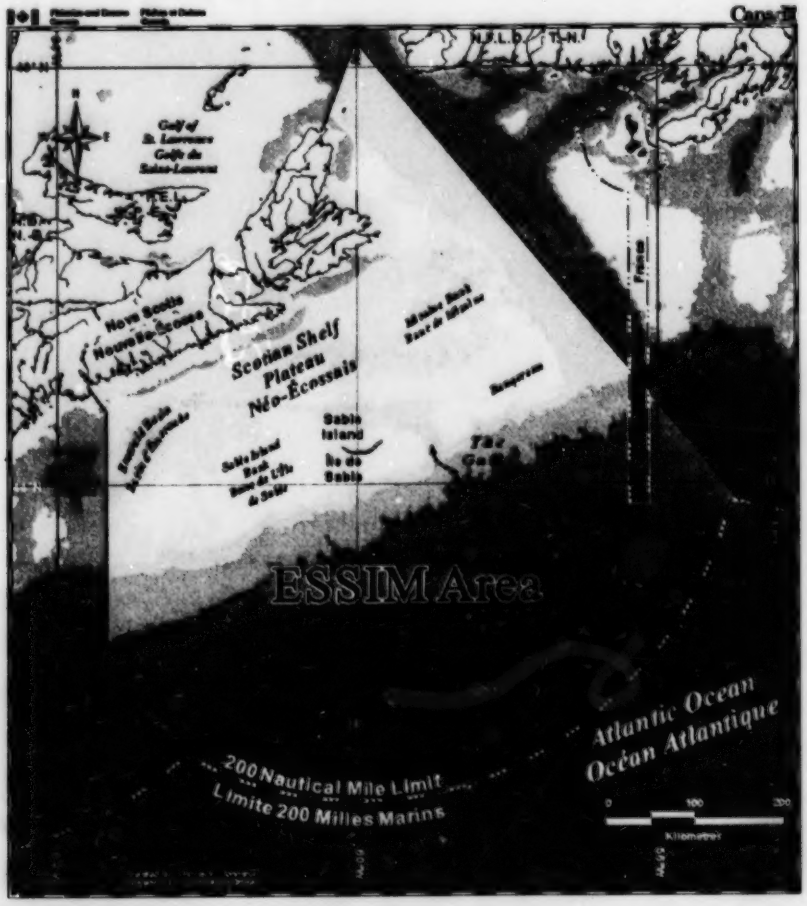
1.0 Introduction

A Workshop on the Ecosystem Considerations for the Eastern Scotian Shelf Integrated Management (ESSIM)[1] Area was held at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, 19–23 June 2000 (O'Boyle, 2000). Objective 4 of the workshop was:

"To describe conservation objectives and regulatory measures for existing management plans, policies and programs of government and ocean industries in NAFO Division 4VW (*i.e.*, fisheries, oil and gas etc.) and the changes needed to incorporate ecosystem objectives."

At the request of workshop organisers, a report was prepared for presentation at the workshop by the present authors that addressed this objective. The present document is a revised and peer-reviewed version of that report.

The ocean use sectors addressed in this contribution are fisheries, oil and gas, marine transportation, maritime defence operations, and potential ocean mining. Other ocean use sectors such as submarine cable laying, recreational activities, scientific research and aquaculture are not addressed, either because effects on the ecosystem are thought to be minor or the activities are coastal in nature and outside the offshore study area of the ESSIM Initiative (see map below.)



[1] A list of acronym definitions is provided in Annex 1.

The chosen ocean sectors are analyzed to determine the extent to which emerging operational definitions of ecosystem objectives are incorporated in current sector management planning and the changes required for defined ecosystem objectives to be adequately addressed. The following categories of information are provided for each sector: activities and trends (spatial and temporal); nature of use and effects (extractions and inputs); governance and institutional framework (regulatory measures and management approaches); ecosystem issues and the extent to which they are addressed; and changes required in institutional structure and function to address ecosystem objectives. In addition to sector-specific considerations, this contribution addresses cumulative ecosystem effects.

The *Oceans Act* calls for an ecosystem approach to the management of ocean use. This approach emphasizes the need to collect and synthesize information on ecosystem structure and function, recognizes that different components within an ecosystem are interrelated and interdependent, and necessitates management strategies that are anticipatory and ecologically sound. The provisions of the Act for marine protected areas and marine environmental quality can be used to maintain natural biological diversity and the productivity of all living resources in the marine ecosystem. Integrated oceans management under the Act is a dynamic planning process by which decisions are made for the sustainable use, development, and protection of coastal and marine ecosystems and resources.

The *Oceans Act* does not, however, establish any specific attributes of ecosystems that can be used to define criteria against which sustainability of use can be judged. The ecosystem objectives used for the present analysis were derived from proposals made at the ICES/SCOR symposium on the Ecosystem Effects of Fishing held in Montpellier, France in March 1999 (Gislason et al., 2000), as developed further during the ESSIM workshop itself (O'Boyle, 2000). The objectives used are as follows:

- Maintenance of diversity of ecosystem types
- Maintenance of species diversity
- Maintenance of genetic variability within species
- Maintenance of the productivity of directly impacted species
- Maintenance of the productivity of ecologically dependent species
- Maintenance of ecosystem structure and function
- Maintenance of marine environmental quality

Although fisheries management has provided the primary focus for development of indicators and reference points for these ecosystem attributes, these are suitable also for use in management of other sectors.

It is emphasized that this is a new list of objectives for ecosystem management. The institutions and policy frameworks that have been created to regulate the various ocean uses considered here were established to meet only a subset of these criteria. The present evaluations are directed primarily toward identifying what changes are required to meet the new proposed criteria that are relevant to a sector. As an interim step, however, it is necessary to establish the scope of present conservation objectives and whether plans, policies and programs already instituted are meeting these previously established requirements.

2.0 Governance Structures

The term 'governance' refers to the regime used to govern public and private behaviour relative to an ocean area and the resources and human activities contained therein. Therefore, it includes government legislative and management frameworks (federal and provincial), industry and user group management structures, as well as the activities of other non-governmental entities, such as coastal communities, non-

governmental organizations and individuals. At the federal level, the eastern Scotian Shelf is currently managed and regulated by a broad range of government departments and agencies. Key federal departments with mandates/responsibilities that affect the marine ecosystem are:

Federal Department/Agency	Mandate/Regulatory Responsibility
Fisheries and Oceans/Canadian Coast Guard	Fisheries resource management; marine conservation and protection; marine environmental protection; ocean science and understanding; marine safety; integrated oceans management, marine protected areas, and marine environmental quality
Transport Canada	Marine safety (ship safety and regulation); ship-source pollution prevention and control; ports and harbour authorities; ferry services
Environment Canada/Canadian Wildlife Service	Environmental protection and response; ocean dumping; environmental (wildlife) conservation and enforcement; atmospheric services
Canadian Environmental Assessment Agency	Federal environmental assessment
Natural Resources Canada/Geological Survey of Canada	Natural resources (energy, metals and minerals); earth sciences; marine geosciences (regional, resource and environmental) and mapping
National Defence/Maritime Forces	Maritime security and defence; search and rescue; ocean surveillance and information management; enforcement support to civilian agencies

Other relevant federal departments include: Parks Canada/Canadian Heritage (marine conservation areas, historic/cultural sites); Industry Canada (submarine cables); Royal Canadian Mounted Police (Solicitor General) (law enforcement); Citizenship and Immigration (illegal immigration); Department of Justice (application of laws and regulations); Foreign Affairs and International Trade (permits for foreign research and access to resources); Canada Customs and Revenue Agency (control of smuggling); National Energy Board (environmental and emergency response, research and development).

The Canada-Nova Scotia Offshore Petroleum Board, an independent joint agency of the federal and provincial governments, is mandated to regulate offshore oil and gas through environmental and safety regulations and development authorizations.

Departments and agencies of the Province of Nova Scotia having ocean-related management and regulatory interests in the area include:

Provincial Department/Agency	Mandate/Regulatory Responsibility
Department of Agriculture and Fisheries	Fisheries management and conservation for some species; fish processing sector; aquaculture development
Department of Natural Resources	Protection of coastal environments (*e.g.*, beaches, wetlands); coastal development and construction
Petroleum Directorate	Oil and gas (provincial management and development; royalties)
Department of Municipal Affairs	Coastal land-use planning
Department of Environment and Labour	Environmental protection and assessment; labour codes

3.0 Ecosystem Considerations for Selected Ocean Use Sectors

3.1 FISHERIES

3.1.1 Sector Activities and Trends

The eastern Scotian Shelf has traditionally supported important domestic fisheries for the groundfish species, cod, haddock, pollock, redfish, small flounders (plaice, yellowtail, witch), and halibut. Groundfish species of lesser importance have been cusk, white hake and wolffish. In September 1993, the fisheries for the most important groundfish stocks (cod and haddock) on the eastern Scotian Shelf were closed, and strict limits were put on other fisheries that landed these stocks as bycatch. These fisheries remain closed and, although silver hake, skate, monkfish and turbot fisheries have taken on some importance, the result has been withdrawal of groundfish effort from many grounds east of Halifax.

Fisheries for invertebrate species have increased significantly on the Scotian Shelf banks in recent years to the point where scallop, shrimp, crab and surf clam fisheries are of greater importance than the groundfish fishery.

Fisheries for the small pelagic species, herring and mackerel, are primarily coastal, but resurgence of the eastern Scotian Shelf banks herring stock has supported a fishery of some importance since 1996. Large pelagic species, swordfish, tunas and sharks, support fisheries of large geographic scale, mainly along the outer shelf and slope, that includes the eastern Scotian Shelf.

Foreign fisheries on the eastern Scotian Shelf are now negligible. Subsequent to extension of jurisdiction in 1977, large-scale foreign fishing has been allowed only for silver hake and squid and only within a restricted area along the shelf edge known as the Silver Hake Box (bounded by the Small Mesh Gear Line (SMGL)). However, squid have not occurred in commercial abundance since the early 1980s and foreign allocations for silver hake have been phased out. The Japanese pelagic longline fleet (1–10 vessels) is still allowed to prosecute part of its fishery for tunas (other than bluefin) immediately adjacent to the shelf (outside the 1000 fathom contour until November 15, then outside the SMGL).

3.1.2 Nature of Uses and Effects

A diversity of gears is used in groundfish fishing, including otter trawls, Danish seines, bottom gillnets and hook and line gears (primarily longline). Otter trawls employ boards that stir up sediment plumes that aid the herding effect of the bridles that connect the doors to the wings of the net. The footrope of the net is usually equipped with rollers that also cause some bottom disturbance. Danish seiners, although also dragged over the bottom, do not employ boards or rollers and hence bottom disruption is substantially lower. Other groundfish gears disturb bottom habitat very little.

Scallop dredges, or rakes, and the hydraulic dredges used in the surf clam fishery can cause substantial bottom disruption. Shrimp fishing is conducted primarily by otter trawl with traps being used on coastal grounds. Shrimp trawls use otter boards and heavy rollers similar to those used on groundfish trawls. Crab fisheries are conducted using traps, which are usually considered to have little or no effect on bottom habitat (although the setting of large numbers of traps in sensitive, *e.g.*, coral-rich areas could have adverse ecological effects).

The offshore banks herring fishery is conducted with pelagic purse seines and large pelagic species are caught using surface longlines. Neither of these gears affects bottom habitat.

All these fishing gears catch not only the target species but also various other species incidentally. In some cases, these species also have commercial value and are landed and sold. However, there are also cases where incidentally caught species are discarded at sea because they are of little or no value, or as a direct or indirect result of regulation. In some circumstances, incidental catches may be of species considered to require special protection. For example, marine mammals may become entangled in fixed gears, gillnets in particular. Various modifications to gears, or to the spatial or temporal distribution of fishing, have been adopted to address species bycatch problems.

Fishing gears are also capable of catching a wider size range of species than is useable commercially, or is allowed under regulation. Various features of gears are designed to tailor the size range caught to that that can be retained and sold, such as mesh sizes and types, separator grates and escape vents.

3.1.3 Governance: The Integrated Fishery Management Plan (IFMP) Process

All directed fisheries on the eastern Scotian Shelf are expected to have Integrated Fishery Management Plans (IFMPs). Multi-year plans are encouraged. The IFMP process was initiated in 1995. It operates under a set of guidelines, most recently revised in January 1999, which define the planning process and provide a template for plan documentation. The IFMP is based on peer-reviewed scientific advice through the DFO Regional Advisory Process (RAP) and other information from Departmental and stakeholder sources. The term "integrated" in IFMP emphasizes the need for the plan to be a cohesive whole and for a co-operative approach among DFO sectors, *e.g.*, the inclusion of, for example, scientists, surveillance staff, economists, and resource managers in the plan's development. Input from all stakeholders, not only resource users, is expected, mainly through advisory committees. Within the context of the Atlantic Fishery Regulations and any other regulations promulgated under the *Fisheries Act*, and of ministerial policy, the IFMP is expected to provide a clear and concise summary of the management objectives for the fishery, the measures used to achieve these, and the criteria by which attainment of them will be measured. In the case of groundfish and lobster plans, Conservation Harvesting Plans are included as appendices. IFMPs are not legal contracts and guidelines stress that they should not employ wording that implies a binding agreement.

Joint Project Agreements (JPAs) between DFO and stakeholders can be entered into that, although independent of the IFMP, are supportive of it. A Joint Project Agreement is a fishery co-management tool that sets out the roles and responsibilities of DFO and other parties with respect to a particular project in areas such as Science and Surveillance and Enforcement, and includes sharing of financial responsibilities. In contrast to IFMPs, the parties to the JPA are legally bound to the terms and conditions of the agreement. Among fisheries on the eastern Scotian Shelf, JPAs exist for Scotian Shelf shrimp, 4W exploratory offshore lobster, and the surf clam fisheries, and one may be developed in the snow crab fishery.

The Resource Management Branch has lead responsibility for IFMP development. However, each relevant sector and branch is expected to contribute to creation of an IFMP draft to present at consultations with stakeholders (normally through an advisory committee). Adjustments to the draft are made, approval sought at the necessary level (Regional Director-General, Assistant Deputy Minister, Minister and co-management board) and the plan adopted. Implementation allows for adjustments consistent with contingencies included in the plan or where there are new conservation concerns, but members of the advisory committee are to be consulted in the event of major in-season changes in the IFMP. Data required to evaluate effectiveness of the plan are to be collected. A post-season review is to be conducted of plan performance against pre-established criteria and the results incorporated into next year's (cycle's) plan.

The Oceans Branch is responsible for informing the Resource Management Branch about initiatives under the *Oceans Act*, *e.g.*, Marine Protected Areas, which might have implications for planning. Plans are expected to take account of the affect such initiatives may have on execution of the fishery, but the guidelines do not require any active consideration of ecosystem issues beyond conservation of the directed species.

Among external advisory bodies, the Fisheries Resource Conservation Council (FRCC) is presently the most influential as it, not DFO Science, has the mandate to advise the Minister on conservation measures for Atlantic groundfish stocks. (DFO Science has the responsibility for research on and determination of stock status of groundfish.) The FRCC objectives include development of "a more profound understanding of fish-producing ecosystems including the inter-relationships between species and the effects of changes in the marine environment on stocks." This overlap between FRCC and DFO roles in groundfish plan development (and their separate relationship with stakeholders) is not recognised in IFMP process documentation.

The following IFMPs for the eastern Scotian Shelf (4VW outside 12 n.m.) are relevant to the present study. (Plans used are the most recent available as of May 2000.)

MARINE MAMMALS

- Atlantic Seal Hunt 1999 Management Plan

PELAGICS

- 1997-1999 Integrated Fisheries Management Plan Atlantic Mackerel
- 1999-2001 Scotia-Fundy Fisheries Integrated Herring Management Plan NAFO Sub-divisions 4WX, 4Vn and 5Z
- Canadian Atlantic Pelagic Shark Integrated Fishery Management Plan 1997-1999
- Canadian Atlantic Swordfish Fishery 1997-1999 Management Plan
- Canadian Atlantic Integrated Fishery Management Plan Bigeye, Yellowfin, Albacore Tunas 1998-1999
- 1999-2000 Integrated Fisheries Management Plan Atlantic Bluefin Tuna

GROUNDFISH

- Integrated Fisheries Management Plan Atlantic Groundfish 1999

INVERTEBRATES

- 1998/99 Scotia Fundy Offshore Scallop Integrated Fisheries Management Plan, Maritimes Region
- 1998 Snow Crab Integrated Fisheries Management Plan, Scotia-Fundy Fisheries, Maritimes Region
- 1998 Eastern Nova Scotia Offshore Multi-Species Crab Fishery Integrated Fisheries Management Plan, Scotia-Fundy Fisheries, Maritimes Region
- 1998 Rock and Jonah Crab Integrated Fisheries Management Plan, Eastern Nova Scotia, Scotia-Fundy Fisheries, Maritimes Region
- 1998-2002 Scotian Shelf Shrimp Integrated Mobile Gear Fisheries Management Plan, Scotia-Fundy Fisheries, Maritimes Region
- Offshore Surf Clam Integrated Fisheries Management Plan, Maritimes and Newfoundland Regions 1998-2002

3.1.4 Plan Provisions in Relation to Ecosystem Objectives

The list of potential ecosystem concerns given in Section 1.0 are translated into issues considered relevant to fisheries as follows:

Objective	Issues
• Maintenance of diversity of ecosystem types	• Modification of bottom habitat
• Maintenance of species diversity	• Protection of species at risk, low productivity and narrow niche species
• Maintenance of genetic variability within species	• Maintenance of population richness within management units
• Maintenance of the productivity of directly impacted species	• Fishing mortality on directed and bycatch species
• Maintenance of the productivity of ecologically dependent species	• Taking predation mortality into account when setting harvest levels for forage species
• Maintenance of ecosystem structure and function	• NOT CONSIDERED: Issues not yet adequately defined
• Maintenance of marine environmental quality	• NOT CONSIDERED: Effects thought to be unimportant

These issues are used here to judge whether any provisions in present IFMPs address ecosystem objectives. Each plan in the above list of plans was examined in relation to the list of ecosystem objectives to determine if the latter were addressed. When it was known that a particular objective was addressed elsewhere but in the plan, *e.g.*, in policy or regulation, or was under investigation through a research program (funded through a JPA or otherwise), that too was noted. Results are summarised in the following tables.

Table 3.1. Maintenance of Diversity of Ecosystem Types – Modification of Bottom Habitat.

Plan	Provision
Groundfish 1999	Not addressed in IFMP but effects on habitat being investigated by DFO.
Offshore Scallop 1998-99	Not addressed in IFMP.
Offshore Surf Clam 1998-2002	Plan recognizes the possibility of long term deleterious effects of hydraulic dredging and research is being funded through an accompanying Joint Project Agreement (JPA).
Notes	
Plans not mentioned have no recognised relevance.	

Table 3.2. Maintenance of Species Diversity – Protection of species at risk, low productivity and narrow niche species.

Plan	Provision
Groundfish 1999	Mortalities of harbour porpoises in groundfish gillnets in the Bay of Fundy were reduced to acceptable levels by fishermen voluntarily modifying gear and fishing practices. However, this is not documented in the IFMP. Entanglement of right whales in fixed gears in Bay of Fundy is addressed in the draft right whale recovery plan now being implemented. However, this is not noted in the IFMP. The IFMP severely restricts catches of the narrow niche species, cusk and white

	hake, but does not accord special attention to these and other strictly boreal species with restricted distributions (*e.g.*, haddock, pollock, Acadian redfish, argentine). The IFMP makes no special provision for protection of the low productivity elasmobranchs.
Shark 1997-99	Plan recognises the need for low exploitation due to low species productivity but mortality may still be too high for wide-ranging shark species, such as mako and blue, because of unrecorded bycatch and discarding from other, including international, fisheries.
Notes	
Leatherback turtles, classified as an endangered species, become entangled in pelagic longlines, groundfish gillnets and lobster traps. Loggerhead turtles are regularly hooked on pelagic longlines. Turtles are normally released alive but survival rate is not known. To date there has been no recognition of this issue in pertinent IFMPs (although work on a leatherback turtle recovery plan is ongoing).	

Table 3.3. Maintenance of Genetic Variability within Species – Maintenance of Population Richness within Management Units.

Plan	Provision
Herring 1999-2001	IFMP provides for limitation of catch by spawning group within management unit.
Notes	
Management units are defined in IFMPs to permit separate regulation of catches by major stocks or stock groupings. However, in many cases stock structure is not well known and management units are fairly arbitrary.	

Table 3.4. Maintenance of the Productivity of Directly Impacted Species – Fishing Mortality on Directed and Bycatch Species.

Plan	Provision
Seals 1999	Removals of grey and harbour seals are insignificant in relation to population sizes.
Mackerel 1997-99	TACs and minimum fish sizes are set to regulate mortality rate and size at first capture. Provision is made to minimize herring bycatches.
Herring 1999-2001	TACs and minimum fish sizes are set to regulate mortality rate and size at first capture. Dumping of herring is forbidden. Salmon and tuna bycatches are not allowed.
Shark 1997-99	Porbeagle and blue shark fishing effort (catch also for porbeagle) not to exceed 1995 levels. No size limits in effect. To minimize bycatches of swordfish, no directed fishery is allowed for shortfin mako or other sharks (but bycatches can be up to 50% of directed species catch). Bycatches of tunas and swordfish must be released, alive if possible. Finning prohibited unless carcasses are landed to match.
Swordfish 1997-99	Canadian quota and minimum size in effect (ICCAT). No restrictions are placed on tuna (other than bluefin) and shark bycatches. Bluefin tuna cannot be landed (and bycatch minimized through timing and location of fishery). Finning of sharks prohibited unless carcasses are landed to match.
Bluefin Tuna 1999-2000	Canadian quota and minimum size limits in effect (ICCAT). Bycatch of other tunas can be retained.
Other Tunas 1998-99	No catch limits in effect but minimum size set (ICCAT). Only one 'offshore tuna licence' exists and tonnages are set for bluefin and swordfish bycatch. Swordfish licence holders can direct for 'other tunas' under either their swordfish or 'other tunas'

	licences using pelagic longline gear, but bycatches of swordfish must be covered by allocations. Bluefin tuna licence holders, who use tended line, rod and reel or electric harpoon, may retain incidental catches of other tunas. Finning of sharks prohibited unless carcasses are landed to match.
Groundfish 1999	TACs, minimum fish sizes and gear restrictions, particularly mesh (or hook) sizes, are set to regulate mortality rate on, and size at first capture of, target species. Spawning area/seasons and juvenile areas closed to all groundfish fishing are in effect for protection of haddock stocks. Bycatch limits are set and most bycatch species must be landed. Small-mesh fishing for silver hake is allowed only in defined areas, and separator grates are required in trawls, to minimize gadoid bycatches. Small-mesh fishing for redfish is not allowed in various areas to reduce the possibility of catching small animals, of either redfish or other species.
Offshore Scallop 1998-99	TACs and size limits (maximum meat counts) are set to regulate mortality rate and size at first capture. All bycatches are required to be discarded except for monkfish.
Snow Crab 1998	TACs, trap limits and minimum size are set to regulate mortality rate and size at first capture. Degradable panels in traps to prevent ghost fishing, and escape gaps for lobsters, are required.
Rock and Jonah Crab 1998	Licensing and trap limits provide some control on mortality rate, and a minimum size limit regulates size at first capture. Degradable panels in traps to prevent ghost fishing, and escape gaps for lobsters, are required. All bycatches must be discarded.
Shrimp 1998-2002	TACs set to control exploitation rate. Separator grates are required to minimize bycatches of groundfish and capelin.
Offshore Surf Clam 1998-2002	No directed fishing is permitted for any other mollusc species but there are no restrictions on bycatch amounts except for quahogs where 10% allowed. Bycatches of groundfish cannot be retained.

Table 3.5. Maintenance of the Productivity of Ecologically Dependent Species – Taking Predation Mortality into Account when Setting Harvest Levels for Forage Species.

Plan	Provision
Herring 1999-2001	Nothing in IFMP text but Appendix G (the relevant Stock Status Report) recognises the importance of herring as a forage species in setting allowable catches. It is implied that this is a consideration in setting of TACs.

Notes

Presently, there are no fisheries (and hence no IFMPs) for capelin and sandlance, and fishery proposals for krill fishing have not been approved. However, shrimp and crab plans do not address the issue of trophic interactions. The shrimp plan nonetheless recognizes that the decreases in groundfish and pelagic fish may have led to increase in the size of shrimp populations. In the case of grey seals, there is concern expressed in the plan about the predation effects of seals on the potential stock recovery/yields of groundfish species, and an expanded hunt or a cull are viewed as options for addressing this issue. The mackerel IFMP notes its importance as a predator of juvenile herring and cod, and as a prey of seabirds, tuna and marine mammals.

3.1.5 Does, or can, the IFMP System Accommodate Ecosystem Level Requirements?

The IFMPs currently in effect address only a limited spectrum of what have recently been identified as ecosystem considerations. Almost all conservation provisions of plans relate to control of exploitation rate of the directed species and of species taken as bycatch (Table 3.4). Both the levels of exploitation and its distribution over size/age are addressed. The preoccupation with control of fishing mortality on

the directed species is as expected, of course, as this is the primary conservation issue that this planning process was designed to address.

Maintenance of species diversity and of genetic variability within species are, in whole or in part, issues that also fall within the purview of present plans. Maintenance of population richness within the management unit, *i.e.*, control of mortality on each spawning component, protects the productivity of the directed (or bycatch) species. At present, specific provision is made for this only in the case of herring (Table 3.3), but there is nothing in the present planning process that prevents this issue from being adequately considered for any species. Protection of species at risk, low productivity and narrow niche species (Table 3.2) may also be within the scope of present plans, *e.g.*, skates and cusk in the groundfish plan. Other cases may not concern the species covered by a plan, such as entanglement of harbour porpoise, right whales and leatherback turtles in fixed gears.

In addition to species at risk that are not direct concerns of IFMPs, maintenance of ecosystem diversity, ecologically dependent species, ecosystem structure and function (whatever that turns out to mean) and environmental quality also do not fall within the category of issues covered by plans. Nonetheless, trophic interactions are already a consideration in the setting of herring TACs (Table 3.5, and have been for capelin TAC-setting in other Regions for about 25 years). The effects of hydraulic dredging on bottom habitat are also being considered within the context of the surf clam plan (Table 3.1). Thus, although these categories of ecosystem-level concerns are not widely addressed within current plans, there is no barrier to their inclusion in the objectives of individual plans.

IFMPs are established on the basis of each directed fishery independently without requirement to consider potential conflicts among plans. This is countered to some extent by having a single plan for all groundfish fisheries. Moves to combine institutions managing similar fisheries, *i.e.*, formation of the Atlantic Large Pelagic Advisory Committee which is responsible for shark, swordfish and tuna plans, also seems to have resulted in improved co-ordination of bycatch measures among these pelagic longline fisheries. Nonetheless, there are no institutional arrangements in place to address potential conflicts among the provisions of different plans, such as whether closed areas in the groundfish and lobster plans should apply also to scallop fishing and whether groundfish (monkfish) bycatch allowances in scallop fisheries are consistent with provisions of the groundfish plan.

In conclusion, the IFMP process was instituted, prior to the passage of the *Oceans Act*, for the management of directed fisheries. However, the issues of control of exploitation of directly impacted species, maintenance of genetic variability, and many elements of protecting species diversity are implicit in the objectives of IFMPs. The remaining ecosystem issues of maintaining diversity of ecosystem types, ecologically dependent species, marine environmental quality and ecosystem structure and function could be added to the objectives of IFMPs, which would then serve as the mechanism for deciding on necessary actions and planning for implementation. In other words, IFMPs are suitable vehicles for the application of ecosystem conservation measures.

Overview mechanisms will need to be institutionalised, however, for both Science advice and Fisheries Management planning. The operational requirements for meeting defined ecosystem conservation objectives need to be established at a level above that of planning for individual fisheries. Stakeholders in specific fisheries cannot be expected to impose restrictions on their own actions that benefit not themselves but others, or even for a greater good, unless there is a stipulation to this effect.

3.1.6 Does the IFMP System Function Effectively?

Although the IFMP process has been in effect since 1995, plans vary greatly in their degree of conformity with national guidelines. Based on a departmental audit report (DFO, 1997) and a review of the plan template and of example plans by the Fisheries Management Studies Working Group of RAP (RAP, 1998), revised guidelines were introduced in January 1999. A new national initiative is underway to strengthen objective setting, performance monitoring and review requirements, and to introduce risk analysis as a planning element. The process was identified as being deficient in:

- providing operational (quantifiable) objectives,
- linking plan elements, *i.e.*, strategies with objectives and regulatory measures with strategies,
- documenting compliance problems and how surveillance and enforcement actions would address these,
- providing for collection of data on plan performance (performance indicators), and in
- making adequate provision for plan performance review.

All the IFMPs reviewed in this document (except for herring) were written under the original guidelines. It remains to be seen if the new guidelines and current initiatives resolve the problems identified. The utility of the IFMPs as a delivery vehicle for ecosystem management measures (as well as their success in meeting their original purposes) depends on this being the case.

The systematic introduction of ecosystem considerations to fishery management requires that the present obscurity of management planning be corrected. For an oversight level of planning to function effectively, a broad community of interest must have ready access to current information on all species plans. The IFMP process provides for participant involvement in formulation and implementation of plans, primarily through advisory committees. All participants in the fishery that is subject to a plan are represented including aboriginal interest groups. There is, however, a lack of transparency in the planning and evaluation process. Management plans have not been widely available to the public or, indeed, within DFO. Documentation of the proceedings of advisory committees is sparse and inaccessible to non-participants. Management plans are sometimes renewed without change but there is no mechanism for public notification, making it difficult for the outsider to be knowledgeable of current practices. (Most do not even have a date of issue.) The first step toward a solution has been taken in a decision to provide future plans electronically on the web. A communications strategy with web-based access as a central element presents a practical way of supporting an integrated regional fishery management process.

The role of FRCC in relation to such an integrated regional fishery management process needs consideration. There are two elements to this; its advisory role on conservation measures (currently limited to groundfish) and, as noted above, its mandate to consider the functioning of "fish-producing ecosystems." As the IFMP planning concept develops it is increasingly difficult to envision how an arms-length ministerial advisory body can remain compatible with it. This question, raised in the context of groundfish management planning, needs to be answered also in the design of a regional institutional arrangement for oversight of the planning process in the context of ecosystem issues.

3.2 OIL AND GAS

3.2.1 Sector Activities and Trends

Since the 1950s, over 300,000 km of seismic survey tracks have been recorded and 168 wells (162 in ESSIM Area) have been drilled on the Scotian Shelf, an area comprised of 400,000 km^2. Expenditures

between 1967 and 1997 in the Nova Scotian offshore total about $4.6 billion, including $168 million for seismic surveys. Technical summaries of significant and commercial discoveries indicate that the median expectation of discovered and undiscovered potential resource is 18.1 trillion cubic feet (TCF) of gas, 366.1 million barrels of condensate, and 707.6 million barrels of oil. Since 1990, over $1 billion has been tendered by petroleum companies in the ten calls for bids issued by the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB). The total seabed area currently under CNSOPB leases is 62,332 km^2, an area 12.3 percent larger than Nova Scotia's total landmass of 55,491 km^2. The June 2000 call for bids was for eight land parcels of about 12,500 km^2 and the June 2001 call for bids was for nine land parcels of 15,800 km^2.

The petroleum industry nominates land parcels three months before the CNSOPB calls for bids. As the location of lands is confidential under Accord legislation[2], there is no opportunity for public (or other government department) review of lands for important fisheries and ecological sensitivity prior to the call for bids.[3] Bidding on each land parcel is based solely on the proposed amount of money to be spent on exploration of lands during the first period (5 years) of a nine-year exploration licence. The minimum bid considered for each land parcel is $1 million. A significant discovery licence is an intermediate interest designed to maintain an explorer's rights during the period between the first discovery and eventual production. Production rights are conferred by the issuance of a production licence that may be issued in respect of any portion of the offshore area subject to a commercial discovery.

The leasing process has caused some concern in the context of ecosystem protection and ocean user conflicts. For example, there is spatial overlap of two CNSOPB leased parcels issued from Call for Bids 99–1 and 98–1 with the fisheries conservation area known as the Haddock Box (*i.e.*, Emerald and Western Bank Juvenile Haddock Closed Area). DFO did not provide formal input on these overlaps during the 120-day public review period. This illustrates the need for more effective and transparent planning involving all ocean users, DFO and CNSOPB. Systematic mapping of habitats is needed to improve planning and development through prior identification of sensitive areas.

As of December 31, 2000, total active interests in the Nova Scotia offshore area are as follows:

Type of Interest	Number	Area (km^2)
Exploration Licences	50	61,216
Significant Discovery Licences	33	871
Production Licences	6	245

In addition to the active interests described above, there are two blocks of exploratory permits issued under legislation that has since been replaced. These permits must be converted to exploration licenses before activity can take place on these lands. One area is on Georges Bank (under moratorium till 2012). Another is near the French area of jurisdiction of St. Pierre and Miquelon (provincial boundary under dispute). Until the boundary between Nova Scotia and Newfoundland in the Laurentian Channel is delineated, CNSOPB will not negotiate exploration licences to replace the exploratory permits. An arbitration panel has been struck under Accord legislation to settle the Nova Scotia-Newfoundland offshore boundary dispute. Furthermore, in May 1998, the CNSOPB announced it would not accept bids on land parcel No. 5, NS97–2 adjacent to the Gully.

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[2] *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act*, S.C. 1988, c.28, and the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act*, S.N.S. 1987, c.3. ("Accord Implementation Acts" or "Accord Acts").

[3] A 120-day period for public comment commences with the bidding process.

The recently abandoned Cohasset Project produced over 45 million barrels of recoverable oil during its 7-year project life, while the physical infrastructure remains on site. The $6.1 billion Sable Offshore Energy Project, with a 25-year project life, involves six natural gas fields with an estimated 85 billion m^3 (3 TCF) of recoverable gas reserves. New discoveries could extend the project life. The gas project has two phases with three fields (Venture, North Triumph and Thebaud) now in production and the remaining fields (South Venture, Glenelg and Alma) coming on stream in six years.

3.2.2 Nature of Uses and Effects

This section describes the nature of waste inputs to the marine environment, seismic effects and other acoustic disturbances. It should be noted that accidental spills have occurred on the Scotian Shelf. During Construction Phase (Jan 1997 – Dec 1999) of the Sable Offshore Energy Project (SOEP) there were 89 total spills, of which 84 were at less than 1 barrel and 5 at 1 to 10 barrels. During the Operations Phase (Jan 2000 – April 2000) of the SOE Project there were 16 total spills, of which 14 were less than 1 barrel and 2 at 1 to 10 barrels.

A. Waste Inputs and Current Guidelines Specifications

There are a variety of waste inputs from oil and gas operations.

Waste Type	Treatment / Compliance
Produced Water Formation water, injection water, and process water	Treated to reduce concentrations of dispersed oil to 40 mg/l or less; Oil concentrations in the discharge >80 mg/l should be reported.
Drilling Muds Cleans and conditions wells, lubricates drill bit, and counter-balance formation pressure	Synthetic-based drilling muds are relatively non-toxic in marine environments compared to oil-based mud formulations and have a high potential to biodegrade. CNSOPB adopted a more stringent regime for hydrocarbon-based drilling muds in January 2000, in effect providing a prohibition on the discharge of hydrocarbon-based drilling fluids.
Drill Solids Subsurface geological formations	Re-injection into sub-surface waste disposal zones. Since January 2000, discharges of hydrocarbon-based drilling fluids on cuttings shall not exceed 1% by weight on cuttings, unless authorized by the Board. The present policy is that all exploration wells shall use water-based muds. Non-hydrocarbon based synthetics will be evaluated on a case-by-case basis. Diesel or highly aromatic oils as the drilling fluid are not to be discharged.
Storage Displacement Water Pumped into and out of oil storage chambers	Treated to reduce oil concentrations to 15 mg/l or less. Oil concentrations >30 mg/l should be reported.
Bilge and Ballast Water Maintains platform stability	Oil concentrations should be treated to levels of 15 mg/l or less. Oil concentrations >15 mg/l should be reported.
Deck Drainage Precipitation, sea spray, wash-down & fire drills	Treated to reduce oil concentrations to 15 mg/l or less. Concentrations in the discharge > 15 mg/l should be reported.

Produced Sand Originates in geological formations, separated from formation fluids, contains scale particles from processing of fluids	Volume recovered is monitored and approval for discharge is granted depending on oil concentration and its aromatic content. Sand must be treated to reduce oil concentrations to the lowest level practicable.
Well Treatment Fluids Well workover, well stimulation, well completion and formation fracturing.	Treated to concentrations of 40 mg/l or less of hydrocarbons in produced water that may contain well treatment fluids. Where feasible, these fluids may be treated as produced water for discharge. Fluids containing diesel or highly aromatic oils should not be used unless recovered and recycled, or transferred to shore. Recovered acid fluids should be neutralized prior to discharge.
Cooling Water Chlorine biocide agent	Restrictions may be imposed on the discharge level of residual chlorine in cooling water. Biocide agents other than chlorine require approval.
Desalination Brine Production of potable water	Discharged without treatment.
Sanitary and Food Wastes	Macerated to 6 mm or less prior to discharge. In some circumstances and in sensitive areas, additional treatment may be required.
Water for Testing Fire Control Systems	Discharged without treatment.
Other Wastes and Residues Sludges from oil-water separation systems, spent lubricants and plastics	Reused, recycled, or recovered and transferred to shore. Naturally occurring radioactive material (scale with low-level radioactivity) must be reported to discuss disposal options.

B. Seismic Effects

To detect petroleum deposits beneath the ocean floor, seismic airguns, arranged in rows behind a small ship, are used. The airguns fire at short intervals, discharging sound blasts intense enough to ricochet off layers of sedimentary rock within the seabed. A large-scale airgun array can produce sounds over 250 decibels, the intensity associated with dynamite. CNSOPB has undertaken a class environmental screening for seismic exploration on the Scotian Shelf. The purpose of the Class Screening is to assess the potential environmental effects from seismic exploration activity, identify appropriate mitigation measures and operating conditions, and identify the assessment requirements of individual seismic programs. Potential effects of seismic exploration on fish, marine mammals, sea turtles and seabirds are provided below:

Effects on Fish: The pressure pulses from seismic arrays could injure adult fish when adjacent to an airgun. Fish will be driven away by the approaching noise source prior to coming close to airguns, but available information indicates that behavioural effects on adult fish are transitory. Captive fish in Australia, 2–5 km from seismic, manifested alarm by swimming faster or to the bottom, or by schooling in tighter circles. Squid showed strong startle responses to nearby airgun start up and evidence that they would alter behaviour significantly at 2–5 km from an approaching large seismic source. Eggs and larvae could be damaged at 1.5–3.0 m from individual airguns. Some mortality of eggs and larvae could occur up to 5.5 m from the largest sub-array (McCauley, et al., 2000; LGL Ltd., 1998).

Effects on Marine Mammals: There may be differences in frequencies heard by baleen *vs* toothed whales. Compared to baleen whales, there is little information on responses of toothed whales to seismic

exploration. Although baleen whales seem tolerant of noise pulses from seismic operations, a substantial proportion within 15 km of an array show avoidance or other strong disturbance reactions. Arctic bowhead whales show avoidance up to 24 km from seismic vessels, but usually demonstrate disturbance effects at 5 to 10 km. Humpback whales in Australia took avoidance reactions in response to seismic surveys 12 km away. Behavioural effects on pilot whales, dolphins and porpoises are noted at about 1 km from an array. Potential adverse effects on northern bottlenose whales and sperm whales are less clear. Ringed and bearded seals in Alaska show localized displacement to an approaching seismic array, with some seals avoiding the area within 150 m of airguns, but few moved to distances beyond 500 m (LGL Ltd., 2000; LGL Ltd., 1998; Richardson, et al., 1995).

Effects on Sea Turtles and Birds: Sea turtles 2 km from seismic surveys in Australia displayed an alarm response. However, a study using both a single airgun, and two smaller airguns, showed considerable tolerance in loggerhead turtles. Effects on seabirds have not been extensively studied, but since no disturbance or mortality has been observed in the few studies undertaken, potential effects are expected to be minor (LGL Ltd., 1998).

C. Other Acoustic Disturbances

In addition to seismic noise, exploration and development activities in the oil and gas industry are responsible for a variety of acoustic disturbances on the continental shelf. Among those other sources are drilling rigs which put out high-energy, low-frequency undersea noise during various phases of exploration and production. To extract the oil and gas, platforms and pipes are constructed, drills positioned, and holes bored into bedrock, leaving a complex of industrial structures which may be demolished with dynamite upon decommissioning.

3.2.3 Governance and Institutional Framework

The principal authorities in the regulation of the offshore oil and natural gas sector in Nova Scotia are the CNSOPB, the Nova Scotia Petroleum Directorate, and the National Energy Board (NEB).

Canada-Nova Scotia Offshore Petroleum Board (CNSOPB): The Board (est. 1990) is an independent joint agency of the governments of Canada and Nova Scotia. The Board's mission is to regulate petroleum activities in Nova Scotia's offshore in an efficient, fair and competent manner. The Board has regulatory responsibility for safety, environment, resource conservation and employment and industrial benefits related to petroleum activities. To ensure effective coordination of all regulatory requirements, the Board takes the lead role in coordinating regulatory activities. The Board has entered into Memoranda of Understanding with appropriate departments and agencies to ensure effective coordination and avoid duplication of work and activities (*e.g.*, a Memorandum of Understanding (MOU) with Environment Canada has been signed and the MOU with DFO is being drafted). However, the Accord Acts protect confidentiality in certain circumstances,[4] which potentially limits the ability of other government departments to respond to issues within their jurisdiction.

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[4] Regarding the disclosure of information, s. 122 (2) of the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act* S.C. 1988 c. 28 states that "subject to section 19 and this section, information or documentation provided for the purposes of this Part or Part III or any regulation made under either Part, whether or not such information or documentation is required to be provided under either Part or any regulation made thereunder, is privileged and shall not knowingly be disclosed without the consent in writing of the person who provided it except for the purposes of the administration or enforcement of either Part or for the purposes of legal proceedings relating to such administration or enforcement."

In January 2001, the Board became a federal authority[5] under the *Canadian Environmental Assessment Act*. As the Act is currently undergoing a five-year review, provisions of the federal environmental assessment process may change.

Nova Scotia Petroleum Directorate: The Petroleum Directorate (est. 1997) consolidates petroleum-related activities of the government of Nova Scotia. The Directorate has direct responsibility for royalty and tax issues, business and economic development and analysis, regulatory and environmental processes, transportation and utilization coordination, and education, training, and benefits.

National Energy Board (NEB): Although the NEB is responsible under the *Canada Oil and Gas Operations Act* for the regulation of oil and gas operations in offshore areas outside Nova Scotia and Newfoundland, it cooperates with CNSOPB and Canada-Newfoundland Offshore Petroleum Board (CNOPB) to reduce regulatory overlap and provide more efficient regulatory services. As outlined here, the responsibilities of the NEB include: construction and operation of pipelines; environmental protection; and environmental assessment.

(i) Pipelines: The pipeline for the Sable Offshore Energy Project required NEB involvement in the regulation of Scotian Shelf offshore oil and gas developments since inter-provincial and international oil and gas pipelines under federal jurisdiction require NEB approval before construction.

(ii) Environmental Protection: NEB's environmental responsibility includes ensuring environmental protection during the planning, construction, operation and abandonment of energy projects within its jurisdiction. When making its decisions, the NEB may take into consideration environmental concerns related to air, land and water pollution, disturbance of renewable and non-renewable resources, and the integrity of natural habitats.

(iii) Environmental Assessment: The *Canadian Environmental Assessment Act* ensures that projects receive appropriate levels of assessment and sets out requirements for environmental assessments by all federal departments and agencies. As Responsible Authority under the CEA Act, the NEB ensures that environmental assessments are conducted for projects under its jurisdiction, according to standards prescribed by legislation.

3.2.4 CNSOPB's Regulatory Approach

The Board uses a three-level approach to environmental protection, namely regulations, guidelines and policies. Regulations exist under Accord legislation and two sets of Guidelines on waste treatment and chemical selection are used as minimum environmental standards for offshore operators. The Board's Policies relate to the discharge of oil-based muds, seismic fisheries liaison observers, environmental assessment procedures, and the Gully. This section describes the marine environmental protection objectives of the Board and related regulatory measures.[6]

A. Environmental Regulations

The Board administers its own environmental regulations relating to environmental standards for offshore operators, including the *Nova Scotia Offshore Petroleum Drilling Regulations* and the *Nova Scotia*

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[5] "Federal authority" means, *inter alia,* a Minister of the Crown in right of Canada and an agency of the Government of Canada or other body established by or pursuant to an Act of Parliament that is ultimately accountable through a Minister of the Crown in right of Canada to Parliament for the conduct of its affairs, subsection 2(1) of the *Canadian Environmental Assessment Act*, S.C. 1992, c. 37.

[6] See http://www.cnsopb.ns.ca/ for additional details.

Petroleum Production and Conservation Regulations, both under the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act*. As a federal authority, the Board also administers regulations pursuant to the *Canadian Environmental Assessment Act*.

Nova Scotia Offshore Petroleum Drilling Regulations: These regulations require facilities to prevent pollution by fuel or chemicals and facilities to burn, vent, store, transport, or otherwise dispose of waste. All waste material, drilling fluid and drill cuttings generated at a site must not create a hazard to safety, health, or the environment. There are specific regulations dealing with sewage, galley, domestic waste, spent or excess acid, and all non-combustible trash (*e.g.*, glass, wire, scrap metal and plastics).

Nova Scotia Offshore Area Petroleum Production and Conservation Regulations: A production operations authorization under these regulations is subject to an environmental protection plan. All waste material produced and stored at a production site must be treated, handled and disposed of in accordance with the environmental protection plan. Compliance monitoring programs must be in place to ensure that the composition of spilled waste material is in accordance with the limits specified in the environmental protection plan.

Canadian Environmental Assessment Act: The objective of the *CEAA* process is to ensure that all physical activities relating to the exploration for and production of oil and gas that require authorization by the Board have been adequately assessed for environmental impacts. The Canadian Environmental Assessment Agency promotes environmental assessment as a planning tool. A federal environmental assessment process is only triggered when the Board, acting as a federal authority, provides a land interest through the authorization of oil and gas development plans and the issuance of production licenses. Other triggers may be in place in the near future if other legislated decisions of the Board are included in the *Law List Regulations*.

Prior to the Board's designation as a federal authority, it adopted procedures that were compatible with the *CEAA* process by requiring proponents to submit an environmental impact statement/environmental protection plan, equivalent to a "screening" or "comprehensive study" under the *CEAA*. The required level of environmental assessment (comprehensive study or screening) is now determined based on an environmental impact statement (EIS) that the proponent must submit with the project application for circulation to other federal departments and the public. The Responsible Authority may refer the project to a public review process (*e.g.*, panel review or mediation). The factors to be considered in every environmental assessment are the same for screenings, comprehensive studies, panel reviews, and mediation, and include the significance of environmental effects and cumulative environmental effects, public comments, mitigating measures, and alternatives to the project.

Comprehensive Study: Large-scale, complex projects with significant environmental impacts identified during the screening process follow the *CEAA* process for a comprehensive study.[7] Offshore oil and gas projects that require a comprehensive study include proposed construction, decommissioning, or abandonment of a platform for petroleum production, offshore pipelines, and proposed offshore exploratory drilling projects in an area where no other offshore exploratory drilling project has been previously assessed under either the *CEAA* or the Environmental Assessment Review Process Guidelines Order.[8] Public participation in comprehensive studies is mandatory.

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[7] *CEAA*, Section 21.

[8] *CEAA Comprehensive Study List Regulations*, ss. 11-15.

Screening: Most environmental assessments initiated under the Act involve screenings.[9] The screening process under CEAA utilises the proponent's environmental impact statement as the screening document. Class screenings may be conducted for projects that are repetitive in nature and whose environmental effects are well understood. Previously, the Board conducted Class Assessments when a particular activity or type of project and the full range of its potential environmental effects had been identified. Under this process, a representative project was assessed and thoroughly documented. Once completed, a Class Assessment was applied to future projects or activities conducted within the same defined parameters. To date, no screening of offshore oil and gas activities has been declared as a class screening by the Canadian Environmental Assessment Agency. The extent of public participation in a screening process is at the discretion of the Responsible Authority.

Panel Review: In most cases development programs will be subject to a panel review, *i.e.*, a full public hearing process under the direction of a Commissioner appointed by the Board (*e.g.*, SOEP).

Mediation: A formal mediation process exists under the Act and alternative dispute resolution mechanisms can be used in an environmental assessment.

B. CNSOPB Environmental Guidelines

Offshore Waste Treatment Guidelines: The objective of the Guidelines is to describe minimum standards for the treatment and/or disposal of wastes associated with routine operations of drilling and production installations offshore. Offshore operators are encouraged to reduce the volume of waste discharged and the concentration of contaminants. Compliance monitoring programs are required for the measurement and reporting of waste discharges and the calculation of absolute quantities of oil and other waste contained in discharges. Environmental effects monitoring programs are required to detect and document any adverse environmental effects. Results of these programs are to be used by CNSOPB in consultation with industry and other interested parties, to determine the adequacy of waste treatment technologies and disposal procedures. These Guidelines are now under review by CNSOPB, CNOPB and NEB in consultation with government, industry, and public stakeholders. The review will also consider results of environmental effects monitoring programs in Canada and the present minimization, treatment and disposal processes. The review is considering the pros and cons of re-issuing the guidelines as Offshore Waste Treatment Regulations.

Offshore Chemical Selection Guidelines: These joint regulatory/industry guidelines have been produced with the following objective: To minimize the impacts from the discharge of chemicals to the marine environment and to promote the use of "environmentally friendly" alternatives where practical. These Guidelines provide a framework for the selection of chemicals used in offshore drilling and production activities and for the treatment and disposal of the chemicals selected. Several regulations exist in domestic legislation providing restrictions on the importation, transportation, handling, use and discharge of chemicals (*e.g.*, *Fisheries Act*, *Canadian Environmental Protection Act, Pest Control Products Act, Transportation of Dangerous Goods Act,* and *Hazardous Products Act*). However, these statutes provide limited direction on the usage and discharge of chemicals into the marine environment from petroleum operations.

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[9] *CEAA*, Section 18. The only oil and gas activity in the Atlantic Provinces to undergo a CEAA screening is the Point Tupper Lateral Pipeline. The Halifax and Saint John Lateral Pipelines resulted in comprehensive studies.

C. CNSOPB Environmental Policies

Policy on Discharge of Oil-based Muds: The objective is to minimize the discharge of petroleum hydrocarbons into the marine environment and reduce the potential for tainting marine organisms. Since January 2000, discharges of hydrocarbon-based drilling fluids on cuttings shall not exceed 1% by weight on cuttings, unless authorized by the Board. This policy applies to any hydrocarbon-based synthetic drilling fluids. As present technology cannot achieve this discharge limit, this in effect is a prohibition on the discharge of hydrocarbon-based drilling fluids. This discharge limit has been extended to cover all drilling operations under the jurisdiction of the Board. The present policy is that all exploration wells shall use water-based muds. Non-hydrocarbon based synthetics will be evaluated on a case-by-case basis.

Policy on Seismic Fisheries Liaison Observers: The objective is to mitigate seismic impacts on mammals and seabirds, and reduce conflict potential at sea. The Board's class environmental screening for seismic exploration includes mitigating measures for operators. To provide effective liaison with fishers who may be in the vicinity of seismic programs, operators are to include a qualified fisheries liaison observer, ideally experienced in observing marine mammals and seabirds. The observer meets with fisheries groups prior to the seismic program and is onboard to reduce conflicts at sea. There have been conflicts between seismic vessels and the swordfishing fleet.

Policy on the Gully: The objective is to minimize the impact of oil and gas operations on the Gully. In May 1998, the CNSOPB announced it would not accept bids on land parcel No. 5, NS97–2 adjacent to the Gully. In January 1999, the Board extended their decision and will not issue any Calls for Bids or authorize activities within the Gully MPA Area of Interest (AOI) (although scientific research and environmental effects monitoring may be authorized). Sable Offshore Energy Inc. has amended their Code of Practice for the Gully to reflect the boundaries of the AOI.

3.2.5 Industry-led Environmental Planning and Management

Sable Offshore Energy Inc. (SOEI) Gully Code of Practice: The objective is to provide clarity to personnel working with SOEI on interactions between project activities and the Gully in order to protect its uniqueness and integrity. This Code addresses waste management and vessel routing and aircraft flights near the Gully. No project-generated vessel traffic is permitted to proceed into the MPA Area of Interest. SOEI-related aircraft are restricted from flying over Sable Island or the DFO Whale Sanctuary, except in a life-threatening emergency or with written approval. Procedures exist for collection of fuel, oil, oily material or lubricants; transport of oil or oily material that is not burned on a vessel, platform or drilling unit; and disposal at a waste disposal facility on land.

SOEI Sable Island Code of Practice: The objective is to protect the uniqueness and integrity of Sable Island. Personnel are not to disembark on Sable Island, fly over the Island, or approach within 1 km of the Island unless required to do so in a life-threatening emergency or with written approval from the appropriate government agencies and written approval from SOEI. The Code of Practice addresses the following: project activities on the Island; vessel routing in the vicinity of the Island; aircraft flights near and over Sable Island; and waste management.

SEEMAG: The Sable Offshore Energy Environmental Effects Monitoring Advisory Group (SEEMAG) is a group of experts mandated by SOEI to provide advice about the design of effects monitoring programs and to review compliance monitoring results. SEEMAG unites SOEI experts with government scientists, environmental consultants, academics, and Aboriginal and fishing industry representatives. SEEMAG has reviewed several environmental effects studies, including studies on water quality, benthic habitat,

sediment chemistry and underwater noise. Advice provided by SEEMAG does not represent the official advice of any government department.

3.2.6 Ecosystem Issues

The three ecosystem objectives that pertain to the oil and gas industry on the Scotian Shelf are the maintenance of diversity of ecosystem types, species diversity and marine environmental quality. Issues of direct relevance to these objectives include seismic and general acoustic effects on fish, fish larvae, marine mammals and sea turtles, the provisions for assessments of exploratory drilling proposals, and wastewater treatment guidelines. Other ecosystem considerations include potential effects on benthic biota of fishery importance and bacteria responsible for primary processes such as nutrient regeneration and contaminant biodegradation and bio-transformation processes. Concerns also exist regarding the effects of produced water discharges on primary production. Cumulative effects from oil and gas activities in association with other environmental stressors, *e.g.*, atmospheric contaminant transport, land-based inputs, and ship-source inputs, are discussed in Section 3.6. This section provides observations on the improvements in regulatory approaches and institutional arrangements needed if the proposed ecosystem objectives are to be met.

Class Assessment for Seismic Surveying: The present CNSOPB Class Assessment[10] to address marine environmental effects of seismic operations on the Scotian Shelf was completed in August 1998 and will be applied to future projects or activities conducted within the same parameters for 5 to 7 years (LGL Ltd., 1998). Within the defined study area, the Class Assessment is supplemented by program-specific environmental assessments for seismic surveying, while full-scale environmental assessments are required for operations outside the study area. The Class Assessment addresses marine environmental issues in an analysis of known and potential effects of underwater noise based on the literature up to 1995. The Class Assessment is to be updated for the 2003 seismic season (*i.e.*, after a five-year period). The application of this class screening for all seismic operations may not be appropriate in view of the growing scientific knowledge and understanding of the impacts of noise in the marine environment (McCauley, et al., 2000; LGL Ltd., 2000) as discussed in Section 3.2.2. Mitigating measures need to be considered for the following cases: (i) where overlapping or adjacent and concurrent seismic exploration programs on the Scotian Shelf produce cumulative effects; and (ii) where seismic programs plan to operate adjacent to the Gully Whale Sanctuary or Area of Interest. Mitigation measures include spatial, seasonal and temporal adjustments in surveys and the adoption of policies to reduce or eliminate areas being surveyed multiple times.

Generic Assessment for Exploration Drilling: CNSOPB's Generic Assessment[11] of Exploration Drilling off Nova Scotia, completed in November 1999 and updated in August 2000, considers that many aspects of offshore exploration wells are common to all such wells and serves as a companion document to site-specific environmental impact assessments and protection plans. The Generic Assessment covers drilling planned for a 5-year period up to 2005 and applies to a large study area of approximately 325,000 km^2, extending from shallow banks to the 4,000-m depth contour. The study area excludes Georges Bank, the Gully Whale Sanctuary, and within 1 nautical mile of Sable Island. The Generic Assessment analysed the potential effects of drilling and the zone of influence of drilling wastes (water-based mud) at five hypothetical locations selected as being representative of the types of areas where drilling could occur within the study area (Sable Island Bank, Laurentian Channel, St. Pierre Bank and two offshore slope

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[10] A class assessment may be conducted by the Board when it considers that a particular activity or type of project, and the full range of its potentially adverse environmental effects, have been identified. The process requires that a representative project be assessed and documented. The assessment can be applied to future projects or activities conducted within the same defined parameters.

[11] A generic assessment is analogous to a class assessment as defined by the CNSOPB.

sites at 789 m and 3,000 m). However, these predicted effects are extrapolated from a model developed by DFO for one site outside of the study area (Georges Bank, Gordon et al., 2000), with biological and physical attributes different from the five hypothetical drilling locations. Model applications by Gordon et al. (2000) on Georges Bank show how the potential for biological effects can vary markedly over small spatial scales. Thus, the assumption in the Generic Assessment that the effects of drilling within the study area are the same regardless of where drilling occurs may not be appropriate in the context of ecosystem objectives to maintain diversity of ecosystem types and species diversity. In particular, drilling on the continental slope, where the ecosystem may be more fragile, should be assessed differently from drilling on the shelf.

Valued Ecosystem Components (VECs): The CNSOPB uses CEAA criteria for environmental impact assessments. The approach begins with the identification of valued ecosystem components (VECs), based on the view that "it is not practical, or necessary, to address all potential interactions between project activities and every component of the natural and human environment" (LGL Ltd., 1999). Under the VEC concept as presented by Beanlands and Duinker (1983), a VEC is defined as each of the environmental attributes or components identified as a result of a social scoping exercise. Social scoping refers to an attempt to identify the attributes or components of the environment for which there is public or professional interest/value. The CNSOPB's environmental protection measures address the ecosystem attributes so defined. The VEC methodology provides an adaptable basis for identifying key issues but present definitions will need to be expanded to address the broader objectives proposed under an ecosystem approach, as well as to include evolving public concerns related to social, cultural and economic uses of the oceans.

Offshore Waste Treatment Guidelines: CNSOPB's Offshore Waste Treatment Guidelines specify the extent to which produced water, drill solids, storage displacement water, bilge and ballast water, and well treatment fluids should be treated prior to discharge. For example, hydrocarbons in produced water are reduced to acceptable levels by hydrocyclone and/or chemical filtration methods. Dilution of wastes with seawater prior to discharge is beneficial in that it changes the behaviour of wastes in the water column, resulting in less potential for impact. Flocculation is reduced and material takes longer to settle to the seabed. Drilling waste concentrations reaching the seabed are spread over a larger area, resulting in less impact, particularly on benthic organisms that lack mobility. However, the regulations restrict the concentrations only of oil, not of other wastes in discharges, nor is account taken of the total quantities of wastes discharged. The proposed ecosystem objectives would require a more holistic approach to discharge management. An important element of this, as the number of offshore oil and gas installations rapidly increases, is the need to consider the cumulative effects of discharges for the industry as a whole (see Section 3.6).

While the composition of produced water will vary from one geological formation to another, new information indicates that fluids may contain increasing quantities of heavy metals, copper, and radioactive material as production wells mature. Maintenance of marine environmental quality will thus require improvements in regulation of contaminant content as new knowledge is acquired. The Offshore Waste Treatment Guidelines are presently updated every five years, but this may prove to be too infrequent to keep pace with changes in the development of drilling fluids. The application of the precautionary approach raises the potential for a reverse onus policy in the development of new drilling fluids.

An ecosystem approach requires that the functioning of the whole ecosystem be taken into account. However, present environmental effects monitoring (EEM) programs are focused on the benthos as there

are no standard methods for monitoring potential pelagic impacts[12] and the depths at which wastes may be discharged under the current Guidelines are not scientifically prescribed. Furthermore, the Guidelines assume that all benthic environments are the same. These are problems to be resolved if maintenance of diversity of ecosystem types and species diversity is to be assured. There is also a need for additional studies to identify the environmental persistence and bioavailability of contaminants that may be biodegraded and/or rendered biologically inert. The scope of EEM programs will need to be enhanced and there will be an increasing need to state requirements more specifically if the knowledge base is to keep pace with industrial developments.

Institutional Considerations: Researchers within DFO have been provided with an opportunity to review the Generic Assessment for Exploration Drilling off Nova Scotia, but a formal response has not been prepared. DFO should establish a formal internal review process, possibly including RAP, to provide scientific review of future proposals and assessments of the effects of oil and gas on the marine environment. The CNSOPB is currently reviewing the Offshore Waste Treatment Guidelines. Here also, there is a greater onus on DFO and Environment Canada to participate broadly in the review of these Guidelines and EEM programs and to ensure that a revised regulatory framework addresses the above observations regarding the regulation of waste discharges.[13]

The CNSOPB leasing process, which is largely confidential given the nature of the competitive oil and gas industry, is of concern to users and management bodies. In the past, there has been no opportunity for public or DFO review of parcel lands for important fisheries and ecological sensitivity prior to the areas being nominated. However, there is a 120-day period for public comment during the bidding process. This timeframe is not consistent with the time needed for DFO to react through the RAP process. DFO's review process will need to take into account this timeframe and advance notice under the DFO-CNSOPB MOU may need to be considered. An alternative approach is for DFO to conduct a RAP meeting to identify sensitive and important areas for presentation to all ocean-related sectors.

3.3 MARINE TRANSPORTATION

3.3.1 Sector Activities and Trends

The strategic location of Nova Scotia on the Great Circle Route between the eastern seaboard of North America and Europe has made the province an important stop for international shipping. Halifax remains one the Atlantic region's most important ports in terms of cargo, as well as naval and shipbuilding activities. In 2000, the Port of Halifax handled 13.9 million metric tonnes and saw 2,366 vessel visits. Statia Terminals at Port Hawkesbury has recently begun to handle large volumes of trans-shipped crude oil – transferring oil cargoes from large oceanic carriers to smaller vessels for servicing smaller ports and harbours along the eastern seaboard. In fact, cargo at Port Hawkesbury doubled in 1997 to 15.9 million tonnes, surpassing Halifax and making it one of the largest ports in Canada by tonnage. Other important regional ports include Sydney and Saint John, New Brunswick.

The Atlantic system of marine transportation and sea-borne trade is a loose knit of trade patterns to and from all parts of the world, in which there are four major traffic patterns:

- the Cabot Strait, a major sea route linking trans-Atlantic shipping routes to the St. Lawrence Seaway and the Great Lakes (approximately 6,400 commercial vessel transits annually);

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[12] Caged mussels suspended in the water column have been used.

[13] In March 2001, DFO Maritimes Region formed a Scientific Advisory Committee on Offshore Petroleum Activities to discuss strategic issues related to offshore petroleum research and development and to provide advice on how the Region responds to scientific issues under the joint DFO/CNSOPB MOU and workplan.

- the ports of Halifax and Saint John, which combine to handle close to 35 million tonnes of cargo every year;
- the movement of international shipping through Canada's Atlantic Exclusive Economic Zone (EEZ) as part of the Great Circle Route between Europe and the eastern seaboard of the United States; and
- the coastwise movement of trans-shipped oil and related petroleum products from Port Hawkesbury/Strait of Canso area to US ports on the eastern seaboard. In 1998, Chedabucto Bay had 1888 vessel movements and 730 movements were reported for the Strait of Canso.

In the Atlantic region, there is nearly a balance between loadings and unloadings, with the tonnage being slightly larger for the former. The major commodity types moved through the region include crude oil and petroleum, minerals and chemicals, paper and forest products, coal and coke, and grains and seed.

In addition to large cargo vessels, the marine transportation sector includes ferry, tugs/barges, recreational boating (*i.e.*, yachts) and cruise ship traffic. Fishing vessels can also be considered in this grouping. For the eastern Scotian Shelf area, the only ferry services of note are the North Sydney – Port aux Basques and Argentia, Newfoundland routes, with about 2070 ferry transits annually through the Cabot Strait. Tugs and barge activities tend to be restricted to coastal, inland and harbour waters, as is the case with recreational boating. Cruise ship traffic around Nova Scotia is on the increase, with over 90 visits to Halifax during the 2000 season (May – November) and about 50 visits to Sydney.

3.3.2 Nature of Uses and Effects

The high volume of shipping activity in the eastern Scotian Shelf raises several important marine ecosystem issues related to ship-source pollution and interactions with marine life.

Ship-Source Pollution

Oil: There are short- and long-term impacts of oily discharges from vessels on marine life, particularly seabirds, and marine environmental quality. The waters between Nova Scotia and Newfoundland are a major crossroads for shipping and migratory seabirds, as shown by the Environment Canada database on seabird vulnerability to ship-source pollution. The illegal operational and accidental discharge of oil and oily wastewater (*e.g.*, through the release of bilge water) results in the oiling of thousands of seabirds each year in the eastern Scotian Shelf area. Given the small amounts of oil required for lethal effects on seabirds, the chronic occurrence of small operational discharges is of concern. Offshore water movements and currents disperse oil over larger areas and may increase the extent of damage. Birds oiled at sea die at sea, and pelagic mortalities are likely underestimated based on numbers that wash ashore. Mortality for offshore/pelagic seabirds may be even higher than for more visible species in inshore areas. The impacts on bird species that have lower rates of reproduction are of particular concern. The cumulative environmental effects of relatively small operational discharges, both accidental and deliberate, actually pose more of a threat to seabird populations than a large-scale accident or spill due to a grounding or collision. At the same time, the potential for such a large-scale accident in the area is growing given the increases in shipping activity. The *Oil Pollution Prevention Regulations*, administered by Transport Canada, currently authorize ship discharges of oily water at 15 ppm in offshore waters.

In addition to the major international shipping routes, areas of risk for oil pollution on the eastern Scotian Shelf include the offshore oil and gas developments around Sable Island (*i.e.*, spills from rigs and support vessels) and the fairly recent increase in oil shipments in and out of Statia Terminals in the Strait of Canso. This petroleum and chemical storage, trans-shipment and bunkering facility accounts for a large percentage of Port Hawkesbury's shipping traffic. Crude oil is shipped in from a number of international sources (principally the North Sea and Nigeria), stored at the terminals, and exported to US ports (*e.g.*,

New York and Philadelphia) via bulk tanker vessels. Vessels arriving with crude oil generally remain at Statia Terminals for two days, while tankers arriving in ballast usually remain for one day.

From an environmental and regulatory perspective, there are important issues to be raised with respect to petroleum trans-shipments in the Strait of Canso. These concerns relate to increased levels of petroleum traffic and related operations in the area.

Ballast Water: The ballasting and de-ballasting of ships can introduce harmful aquatic organisms and pathogens to marine ecosystems. It can also contribute to oil pollution. The high volume of shipping in the region coupled with the fact that these ships are coming from all parts of the world makes ballast water pollution an important consideration. For example, tankers arriving at Statia Terminals come from the eastern USA, Venezuela, Brazil, Nigeria, Greece and Mexico. Since approximately 75 percent of ships arriving at Statia Terminals are in ballast (*i.e.*, mostly small coastal tankers), effects may arise upon de-ballasting. The key issue for the eastern Scotian Shelf area is the extent that ballast water may impact on offshore ecosystems. Mid-ocean ballast water exchange is effective for zooplankton species, but has not proven to be so for phytoplankton. Certain phytoplankton are known to have detrimental effects on fish species when introduced into an ecosystem.

Other Shipboard Wastes: There is potential for accidental discharges of other pollutants and shipboard wastes, including black and grey waters, various chemicals (*e.g.*, PCBs) and solid wastes (*e.g.*, garbage, plastics). The *Canada Shipping Act* and international standards on the maintenance of equipment for waste management and disposal (*e.g.*, collection and treatment systems) regulate these. However, compliance remains an issue given the continued presence of sub-standard ships and practices. Additional concerns of ship-source pollution relate to air emissions, primarily greenhouse gases, from ship operations.

Noise Pollution: The effects of shipping-related noise on marine mammals is also not well understood and requires more attention. This is related to offshore development and increased levels of associated marine traffic. Continued research on the effects of ship-related noise pollution is required, including noise aggregated with other sources (*e.g.*, oil and gas operations).

Interactions with Marine Life

The present use of voluntary procedures (Whale Sanctuary and Notice to Mariners) for avoiding ship/whale collisions in the Sable Gully area has been fairly successful in raising awareness and reducing ship/whale collisions. However, the relatively unknown spatial and seasonal distribution of whales and other marine mammals in the eastern Scotian Shelf offshore area impedes effective vessel traffic management to prevent ship/whale collisions. Given the fact that Northern bottlenose whales in the Gully area are identified as being a species at risk, even a few mortalities from ship collisions may have a significant impact on the population.

3.3.3 Governance and Institutional Framework

The regulation of shipping operations in Canadian waters falls under the jurisdiction of several federal departments and agencies. These are primarily Transport Canada and the Canadian Coast Guard (CCG), with significant supporting roles fulfilled by Canada's Maritime Forces and Environment Canada.

Internationally, there are a number of relevant maritime conventions and agreements governing all aspects of marine transportation. The most important of these international instruments are administered by the International Maritime Organization (IMO). Much of Canada's legal framework regarding marine

transportation operations, safety and pollution is the national implementation of international instruments, such as the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) and the International Convention for the Safety of Life at Sea (SOLAS 74). Canada is also a member of the European Port State Control (Paris MOU) and the Pacific Port State Control (Tokyo MOU) arrangements.

The IMO is developing new regulations for the control of ballast water from ships and Canada has recently developed ballast water guidelines for its waters. Unless otherwise approved, ballast water exchange must occur in waters greater than 2000 m. Earlier proposals for a ballast water exchange zone on the Scotian Shelf between the 2000 m isobath and the 200 nautical mile EEZ have been rejected due to uncertainties about potential ecosystem effects, as well as by the shipping industry for routing purposes. However, under the new guidelines, alternative ballast water exchange zones will be implemented for each maritime region and these assessments will be required. The IMO is also planning to prohibit the application of organotin compounds which act as biocides in anti-fouling systems by January 1, 2003, and to prohibit their presence on ships by January 1, 2008.

Transport Canada – Marine Safety

Marine Safety's mandate encompasses the full spectrum of responsibilities related to ship safety and the protection of the environment, including marine pilotage, and the provision of marine expertise for general and policy matters.

Authorities exercised by Transport Canada are derived from and span the *Canada Shipping Act*, *Arctic Waters Pollution Prevention Act*, *Transportation of Dangerous Goods Act*, *Safe Containers Act*, *Pilotage Act*, *Canada Labour Code*, *Coasting Trade Act* and *Canada Marine Act*. These and a variety of international conventions provide Transport Canada with powers and responsibilities as they relate to the marine transportation system in Canada, including foreign and domestic shipping. Transport Canada is the responsible agency for meeting Canada's international Port State Control responsibilities, such as those under the Paris and Tokyo MOUs.

Key regulations relating to Transport Canada's mandate include the 1993 *Oil Pollution Prevention Regulations* and the 1993 *Standards for the Double Hull Construction of Oil Tankers*. These regulations require the phase out of single hull oil tankers operating in Canadian waters, consistent with the provisions of MARPOL 73/78. All medium and large tankers will be required to be double-hulled within 30 years of the promulgation of the regulations.

In addition, there are several voluntary guidelines and bulletins concerning safety and environmental protection for shipping. Two of these of direct relevance to the eastern Scotian Shelf are the *Guidelines for the Control of Tankers and Bulk Chemical Carriers in Ice Control Zones of Eastern Canada* (JIGS) and *Guidelines for Reporting Incidents involving Dangerous Goods and Harmful Substances*. As noted above, Transport Canada has also worked with a number of government departments and industry to develop *Guidelines for the Control of Ballast Water Discharge from Ships in Waters under Canadian Jurisdiction* (September 2000). As part of this initiative, ballast water management strategies are being assessed, including the identification of alternative ballast water exchange zones for each of Canada's maritime regions.

From the authorities listed above, the role of Marine Safety can be summarized as ensuring the development, application and enforcement of legislation, regulations and safety standards for the design, construction, operation and maintenance of commercial ships, mobile offshore drilling units, air cushion vehicles, and other special purpose vessels. Marine Safety is also responsible for the qualification,

training and examination of officers and crews of commercial vessels, prevention of ship-source pollution, marine occupational health and safety issues pursuant to the *Canada Shipping Act* and *Labour Code*, maintenance of a registry of Canadian ships, licensing of small commercial vessels, and overseeing pilotage matters.

Fisheries and Oceans Canada – Canadian Coast Guard

The mission-related objectives of the Coast Guard are to improve safety, protect the marine environment, support understanding of oceans/maritime activities, facilitate shared use of Canadian waters, and provide marine expertise. The Coast Guard provides services for safety and environmental response, marine navigation, marine communications and traffic management, and icebreaking.

Within the Maritimes Region, Coast Guard program delivery is coordinated through the Regional Operations Centre (ROC) in Dartmouth. The ROC schedules, deploys and tracks resources in accordance with program priorities, as well as providing a focal point for alerting appropriate response agencies to marine emergencies (*e.g.*, Halifax Rescue Coordination Centre) and/or coordinating responses to marine incidents.

The Coast Guard maintains a year-round Notice to Mariners concerning whales in the Gully area (as well as Roseway Basin and the Bay of Fundy).

DFO/CCG maintains an MOU with Transport Canada on Marine Transportation Safety and Environmental Protection. This MOU essentially maintains a close working relationship between Transport Canada and Coast Guard on marine transportation safety and related environmental issues.

National Defence – Maritime Forces Atlantic

The Department of National Defence (DND) is the lead agency for the national Search and Rescue (SAR) Program that involves federal, provincial/territorial and municipal governments, as well as private organizations. There is an Interdepartmental Committee on SAR comprised of representatives from oceans-related departments, including DFO/Coast Guard.

Maritime Forces Atlantic (MARLANT) provides important maritime surveillance, monitoring and control functions in the areas of shipping, marine pollution and safety.

Environment Canada

The Environmental Protection Branch of Environment Canada addresses a broad range of pollution concerns and issues in Canada's oceans and coastal areas. Environment Canada is responsible for the *Canadian Environmental Protection Act* (CEPA) and for the pollution prevention control provisions under the *Fisheries Act*, including the control of discharges into the marine environment. The Environmental Emergencies Section (EES) is a primary resource agency for the provision of scientific and technical advice to the lead agency in the event of environmental emergencies (*e.g.*, oil spills). EES maintains a historical spills/emergencies database for Atlantic Canada. EES also has developed and maintains the Atlantic Region Sensitivity Mapping Program, which incorporates geo-referenced data on biological and human-use resources at-risk, coastal geomorphology, and operational information for the protection of resources and clean-up of spills.

The EES Section Head chairs the Regional Environmental Emergencies Team (REET), which includes representatives from all environment-related federal and provincial agencies and marine industry. REET has three main areas of responsibility: provision of consolidated environmental advice to the lead agency

and responsible party/on-scene commander; planning for spill response; and operational issues during spill response. REET can provide information and expertise on spill behaviour, fate and effects, impacts of hazardous materials, wildlife, fisheries and other natural resource protection/rehabilitation strategies, spill trajectory modelling, sensitivity maps and information, weather/sea-state forecasts and warnings, and environmental damage assessment.

The *Birds Oiled at Sea Initiative* is being led by Canadian Wildlife Service (CWS), in partnership with Environment Canada's Environmental Protection Branch, DFO/Coast Guard, Transport Canada's Marine Safety Branch, and with the support of Canada's Maritime Forces, to address the serious problem of seabird oiling by operational and accidental discharges from ships. CWS has recently developed a *National Policy on Oiled Birds and Oiled Species at Risk* (January 2000) and oversees the *Atlantic Region Migratory Bird Oil Spill Response Plan* (June 1999). In addition to increased pollution surveillance, monitoring and enforcement, CWS and its partners are working at the international regulatory and industry levels to raise awareness of the issue.

Port and Harbour Authorities

Under the *Canada Marine Act*, the federal government has eliminated the Canada Port Corporation and has instituted Port and Harbour Authorities as the primary port management structures. These Authorities have important management powers in their jurisdictional areas, including responsibilities for comprehensive environmental management regimes for port-related activities. Associated with this new structure is the divestiture of responsibilities and activities previously carried out by the federal government (*i.e.*, Transport Canada), as well as significantly reduced government expenditures. In relation to offshore issues on the eastern Scotian Shelf, a major port-related issue is the lack of adequate waste disposal facilities for ships. This has been identified as a major obstacle to the effective implementation of a ballast water management regime for Canadian waters.

Shipping Industry

The shipping industry is inherently international in its structure and governance. In Canada, there are several key industry associations that can be utilized for engaging various components of the industry, including the Canadian Shipping Association and the Canadian Maritime Law Association. The larger shipping lines also have representatives in the Atlantic region, such as Kent Shipping Lines (Irving), Atlantic Container Lines, and Maersk.

Canada's current industry-based oil spill preparedness and response regime was established under the *Canada Shipping Act* in 1995 to enable industry to respond to its own spills of up to 10,000 tonnes in waters south of 60 degrees North latitude. In its lead role for oil spill preparedness and response, the Coast Guard sets certification standards for the industry-operated regime. Response coverage for the industry regime is provided by a network of Response Organizations, which are funded by shipping companies and oil handling facilities operating within their geographical areas of responsibility.

The Canadian Marine Advisory Council (CMAC) is a forum for consultation with the shipping sector on safety, navigation, and marine pollution. The membership includes commercial shippers, fishers, recreational boaters, unions, other levels of government and other federal departments. CMAC is jointly co-ordinated and chaired by senior members of the Transport Canada and the Canadian Coast Guard. CMAC has a Standing Committee on the Marine Environment that is currently working on ballast water and air pollution issues. The Coast Guard has also established the Maritime Advisory Board to provide a national forum for government and industry on Coast Guard-related matters. The Maritimes Seacoast

Advisory Board (MSAB) has participation from maritime industry in the provinces of Nova Scotia, PEI and New Brunswick.

3.3.4 Ecosystem Issues

The main ecosystem impacts from marine transportation involve ship-source pollution, principally oil and ballast water, noise inputs and interactions with marine life through ship collisions. Marine transportation must be considered in relation to ecosystem objectives for biological diversity, particularly the maintenance of species diversity. Impacts on seabirds and marine mammals (*e.g.*, Northern bottlenose whales) are directly related to this ecosystem objective. The potential introduction of invasive species through ballast water could have impacts on ecosystem objectives for biological diversity and ecosystem structure and function (i.e, trophic level balance). Beyond these ecosystem objectives, shipping inputs are a major consideration for objectives relating to marine environmental quality.

There are numerous national and international regulations applied to the shipping industry and an extensive set of controls is in place. However, continued sub-standard shipping practices and international compliance with these regulations remain as challenges. Given the nature of the activity, continued interdepartmental coordination is required, as exemplified by the oiled seabird and ballast water initiatives. Existing interdepartmental MOUs and arrangements, such as the Atlantic Operations Sub-Committee (co-chaired by the Maritime Forces and DFO/CCG) provide important mechanisms for this. Although surveillance, monitoring and enforcement will always be necessary, the achievement of compliance through industry engagement and awareness raising is the most effective means of addressing shipping-related ecosystem effects. More work is required on the analysis of shipping patterns (*i.e.*, mapping) in order to make effective oceans management and planning decisions, such as ballast water management and ship routing in relation to sensitive areas.

3.4 MARITIME DEFENCE OPERATIONS

3.4.1 Sector Activities and Trends

Canada's naval presence on the east coast is provided through Maritime Force Atlantic (MARLANT). The MARLANT Area of Responsibility (AOR) covers approximately 6 million km^2 and extends from the Canada-US boundary in the Gulf of Maine to Greenland (60 degrees North), and includes Canada's eastern Arctic to approximately 95 degrees West. MARLANT's AOR for search and rescue in the eastern Atlantic encompasses 4.7 million km^2.

MARLANT engages in a range of domestic/national operations and activities, including sovereignty patrols, maritime surveillance, naval training and combat readiness, search and rescue (DND is the national lead agency), naval route surveys and mine countermeasures, humanitarian relief and aid to civil authorities, and operational support to other government departments, such as the RCMP (drug law enforcement) and DFO/CCG (fisheries patrols).

To achieve its mandate, MARLANT currently possesses 7 HALIFAX-class Frigates, 2 IROQUOIS-class Destroyers, 1 OBERON-class conventional submarine (4 VICTORIA-class submarines to be fully deployed by 2002), 1 PRESERVER-class Operational Support Ship, 6 KINGSTON-class Maritime Coastal Defence Vessels, 1 Minesweeping Auxiliary, 14 AURORA and 4 ARCTURUS long range Maritime Patrol Aircraft, and 31 SEA KING Helicopters.

MARLANT maintains and coordinates maritime surveillance and response for its AOR. The Canadian Maritime Network (CANMARNET) is an important component of this surveillance and information

management system, and provides multiple government user access to the Recognized Maritime Picture (RMP) and associated intelligence/surveillance information. Key federal departments involved in the compilation and use of the RMP are DFO/CCG, Transport Canada, Canada Customs and Revenue Agency, RCMP, Environment Canada, and Citizenship and Immigration Canada.

3.4.2 Nature of Uses and Effects

In addition to and during the various types of missions/patrols carried out by MARLANT, live weapons firing, bombing and other defence exercises take place in a number of areas in the MARLANT AOR. The principal types of practices include bombing practice from aircraft, anti-aircraft firing from surface vessels, anti-surface firing from surface vessels, and surface and sub-surface exercises. Above routine training exercises and workups, a major multinational exercise, known as Maritime Command Operational Training (MARCOT), occurs in the region every two years and can involve up to 40 vessels for a two-week period.

MARLANT operates in the following exercise areas in or affecting the eastern Scotian Shelf:

ALPHA	Sub-Surface (extends to but excludes Halifax Harbour area)
DELTA 1-4	Sub-Surface; Firing Exercise (includes airspace to 20,000 ft)
ECHO 1	Sub-Surface
ECHO 2	Sub-Surface; Firing Exercise (includes airspace to 20,000 ft)
GOLF 1-4	Sub-Surface; Firing Exercise (includes airspace to 30,000 ft)
HOTEL 1-4	Sub-Surface; Firing Exercise (includes airspace to 30,000 ft)
INDIA	Sub-Surface
JULIET	Sub-Surface
MIKE 1-3	Sub-Surface
NOVEMBER 1-3	Sub-Surface
QUEBEC 1-3	Sub-Surface (does not include Saint-Pierre et Miquelon zone)

Naval ships engage in a range of activity types, including surface firing, fueling, routine shipboard operations, sonar, electronic emissions, sabotage exercises, mine warfare, submarine and aircraft operations, and firefighting measures. The concerns and mitigation measures directly related to marine environmental and wildlife considerations are described below.

Noise Impacts

Naval operations can result in high levels of noise, although these are primarily of short duration. MARLANT surface vessels and submarines use hull-based sonars, towed arrays and towed variable depth sonars (VDS). Military aircraft use dipping sonars and small sonobuoys. NIXIE Acoustic Counter-Measures also emit sound energy to decoy acoustically homing torpedoes, but are used infrequently with localized effects similar to a ship's propeller. Sonar emissions, particularly from active sonar modes in hull-based sonars, VDS and NIXIE counter-measures, have the greatest potential to affect surrounding marine life. Active sonar is used only in designated exercise areas for which an environmental assessment has been conducted. All MARLANT exercise areas on the eastern Scotian Shelf are used for Sub-Surface Operations. Currently, knowledge of the effects of sonar on marine life is not conclusive. To date, no observed effects on marine life from the use of sonar have been identified.

It is important to note that MARLANT area Quebec 3 overlaps with the upper portion of the Sable Gully MPA Area of Interest. Given the presence of a Northern bottlenose whale population, as well as other marine mammals in this area, the potential for noise impacts is intuitively higher for this part of the eastern

Scotian Shelf. MARLANT is supportive of the efforts by DFO and its partners in establishing an MPA in the Gully, and have indicated that its presence and activity in the area is minimal.

Additional noise impacts may come from the use of explosive ordinance in the exercise areas, such as for live fire exercises (surface-to-air; air-to-surface; surface-to-surface), anti-submarine warfare (ASW), and mine-countermeasures (MCM). The largest explosives are used for MCM and range from 10 to 100 kg charges. ASW charges are generally very small (*i.e.*, 1 oz). Avoidance of marine life is the primary means of mitigation. In the case of MCM, a full environmental assessment is required for each exercise. Any use of explosives where the explosive charge exceeds 0.4 kg requires an activity specific environmental assessment. The blast and noise effects are not fully known, but have been deemed to be insignificant. MARLANT areas on the eastern Scotian Shelf that may have exercises using explosives are DELTA 1-4, ECHO 2, GOLF 1-4 and HOTEL 1-4 (south of Halifax). It should be noted that Sea Sparrow and Harpoon missiles and torpedoes are not used in MARLANT exercise areas.

The future use of Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) sonar by the US Navy in Canada's exclusive economic zone is a potential issue for the ESSIM Area.[14] DFO's review of the environmental impact statement is covering all aspects of the sonar operations, focussing on the modelling approaches used to determine potential impacts on marine mammals and other marine life, with particular reference to the inputs and results for the acoustic modelling scenario for Sable Island Bank. An assessment is required of the effectiveness of the mitigation measures proposed to minimize impacts on marine life. Additional mitigation measures or safeguards for LFA sonar operations in Canadian waters may be identified, possibly including a request to expand the existing Offshore Biologically Important Area identified by the US Navy for protection within the 200-m isobath along Canada's east coast to encompass deeper water ecosystems and habitats for certain marine species, (*e.g.*, the Gully).

Ship-Source Pollution

There is potential for accidental discharge of pollutants from ships and submarines. This can include fuel spills (JP5 and distillates, OTTO fuel), liquid wastes (*e.g.*, black and grey water), bilge water, ballast water and sediments, solid wastes, hazardous materials (*e.g.*, PCBs, flammable substances, asbestos, biohazardous/infectious materials, poisons and corrosive agents) and air emissions. Strict adherence to the *Canada Shipping Act* and international standards (*i.e.*, IMO) is built into the fleet management system through a broad range of Maritime Command Orders (MARCORDs). Standard operating procedures are in place for handling and disposing of these materials and for dealing with potential pollutants. The primary directives are found in MARCORD G-18 (Shipboard Waste Management) and MARCORD 66-5 (Hazardous Material Management Program).

The types of ship-source pollution with the highest potential for occurrence and impacts are fuel spills, bilge water and ballast water. The fuels utilized by ships are generally light with volatile components and disperse quickly in the marine environment. OTTO fuels associated with torpedoes are, however, highly toxic and insoluble. At-sea fueling increases the risk of spills given the varying sea states and conditions involved. In terms of other liquid wastes, the newer vessels are equipped with effective Liquid Waste Purification Systems, while older vessels have various systems to deal with these, including oily water separators, oil content monitors, liquid waste treatment systems, grey water collection systems, black water vacuum collection and holding tanks, and chemical toilets. Ballast water is an issue with naval ships (including visiting warships) given the international nature of their operations. At present, naval ships are required to

[14] To date, the use of LFA sonar by the US Navy in Canada's EEZ has only occurred in conjunction with the Canadian Defence Research Establishment Atlantic (DREA).

deballast outside the territorial sea in waters greater than 200 metres depth. The primary mitigation measure is through strict adherence to IMO standards and Maritime Command (MARCOM) guidelines. MARLANT has been involved in the development of ballast water guidelines for Canadian waters. Although the ballast water guidelines are primarily for commercial shipping, it is important that naval ships meet the same standards.

Weapons and Equipment

Misfired ammunition, debris from firing, and various types of spent equipment (*e.g.*, sonobuoys) in the marine environment may pose risks to marine life (and other ocean users as well). For exercise purposes, non-explosive ammunition is used. However, in the case of live ammunition use, there are protocols to ensure that misfired ammunition is discarded overboard as it poses an immediate risk to the crew and ship. To comply with ocean dumping regulations under CEPA, the location and amount of ordinance dumped must be reported immediately to the Coast Guard for inclusion in Notices to Mariners. Jettisoning of ordinance normally takes place in designated zones and in waters deeper than 100 m. Spent equipment in the marine environment, such as sonobuoys or decoys/markers, may discharge chemical by-products or substances from batteries. These discharges are deemed to be sporadic and non-accumulative, although localized impacts to marine life may occur from physical disruption of the bottom and chemical by-products.

In general terms, these activities are not considered to have significant impacts on the marine environment and surrounding life. Most impacts will be of a localized nature. Activities that involve weapons firing and deploying equipment into the marine environment occur only in designated zones.

3.4.3 Governance and Institutional Framework

MARCOM environmental policy states that the letter and the spirit of all applicable federal government laws shall be met or exceeded, and whenever possible, that compatibility with provincial and international standards shall be ensured. These policy directives are applied to the construction, modification and operation of naval vessels and are adhered to, except for cases when national security is threatened or when operating under the *National Emergencies Act,* and for the purposes of saving life or preventing the immediate loss of a naval vessel.

The *Canadian Environmental Assessment Act* requires that DND conduct environmental assessments (EAs) of all activities and projects within its purview, including those specific to naval training and operations. The majority of naval operations do not require full EAs, with the most notable exceptions being live fire outside of designated ranges and the use of underwater explosives. However, it is common for DND to conduct EAs to prove due diligence, even when it is not required under CEAA.

Ships' Environmental Baseline Study

CEAA requires that the scope of the EA encompass support functions critical to the conduct of the activity triggering the EA. Therefore, many routine ship operations, such as ammunition storage and fueling, were being re-assessed in the course of each EA conducted for various activities. The *Ships' Environmental Baseline Study* (SEBS, 1997) was conducted within the purview of CEAA to reduce the EA burden on ships' commanding officers by establishing a benchmark for routine ship operations. It does not, however, absolve commanding officers from their responsibility to exercise due diligence toward the environment. The purpose of the SEBS is to identify potential personnel/environmental concerns associated with routine ship operations, and to list any procedures presently in place, or mitigation measures which can be taken, to reduce the potential impacts associated with these operations. The SEBS is intended for use as a reference

document for the conduct of EAs, reducing both the depth and scope of routine activity assessment. The SEBS is updated as required.

The SEBS divides ships' activities into 12 activity types and includes general descriptions of activities, identified environmental and/or safety concerns, and appropriate mitigation measures where available. These activity types are discussed in Section 3.4.2 on *Nature of Uses and Effects*.

MARLANT Environmental Assessment Process

The MARLANT *Environmental Assessment Guide* (1997) provides a reference collection for naval staff in conducting environmental screenings/assessments, and includes Environmental Registration and Assessment Forms, the MARCOM EA Manual, the CEAA Exclusion List, and the SEBS. The MARCOM EA Manual outlines legal aspects, the EA process, the conduct of the initial environmental screening, as well as the MARCOM Inclusion List.

In terms of naval operations and training, the following projects/activities require an EA:

- Naval exercises involving 15 or more vessels.
- Testing of weapons/live firing in other than established ranges/training areas.
- Destruction of fish by any means other than fishing.
- Activities related to the procurement, testing, construction, operation or disposal of a military weapons platform.

An EA has been conducted for activities in the MARLANT exercise areas (*Assessment of Military Training Exercises in Canadian Forces Maritime Ranges*, Jacques Whitford Environment Ltd., 1995). Although existing training areas were exempt from CEAA requirements, MARLANT conducted the EA to ensure and prove due diligence. Environmental screenings/assessments are conducted for new or non-routine activities in existing exercise areas.

Formation Environment

Formation Environment provides an overview and advice function for naval staff in carrying out environmental screenings/assessments of MARLANT projects and activities. These functions include the assessment of technical accuracy and legislative compliance of environmental screenings/assessments. Regular audits of projects and activities, including ship operations, are conducted to ensure compliance with regulations. Formation Environment maintains an EA registry to document compliance with environmental standards and EA requirements, including MARCOM Orders, Canadian legislation (*e.g.*, CEAA) and international standards (*e.g.*, IMO). Formation Environment staff provide direct links to civilian agencies, such as the Canadian Environmental Assessment Agency and DFO. Formation Environment is in the process of instituting an environmental management system to make all MARLANT units compatible with ISO 2001 environmental standards.

3.4.4 Ecosystem Issues

MARLANT operations have been analyzed in terms of various inputs to the environment, including noise, ship-source pollution, and contamination from weapons and equipment. Mitigation is possible in the vast majority of cases, and environmental planning and extensive controls are in place. That being said, certain defence operations have the potential to affect ecosystem attributes in the eastern Scotian Shelf area. Use of explosives could impact on ecosystem diversity through bottom disturbance and on species diversity through the mortality of marine life (*e.g.*, marine mammals). Noise impacts (*e.g.*, explosions, sonar) and ship-source

pollution could similarly affect species diversity and marine environmental quality more generally. Although the impacts of defence operations are small in comparison with fishing and oil and gas, they do warrant consideration in the context of ecosystem objectives for ocean management.

Given the nature of the military organization and its command and control structure, changes to current operations and procedures required to incorporate ecosystem considerations should be relatively easy to achieve. The key is to continue to involve the Maritime Forces in oceans management and to promote the incorporation of *Oceans Act* principles, such as the ecosystem approach, in its operations and activities. Therefore, engagement of MARLANT staff at the policy, planning and operational levels should continue, and more structured awareness raising should be implemented (*e.g.*, an *Oceans Act* training module could be developed for officer and crew training courses). The Atlantic Operations Sub-Committee and the DFO-led Maritimes Region Federal Interdepartmental Committee on the Oceans may provide useful mechanisms for this purpose. DFO should also strengthen existing links with DND scientific and research staff (*e.g.*, Defence Research Establishment Atlantic) on ocean issues, such as noise impacts on marine life and ballast water.

3.5 OCEAN MINING (POTENTIAL)

3.5.1 Sector Activities and Trends: The Offshore Minerals Management Initiative (OMMI)

Scientists have long known that the seabed and sub-bottom contains mineral deposits, some as common as sand and gravel, others as rare and precious as gold and diamonds. In July 1998, federal and provincial mines ministers reviewed the conclusions of a discussion paper on mineral potential and management options that had been prepared by an intergovernmental working group on the minerals industry. Newfoundland, Nova Scotia and British Columbia asked the federal government to begin a consultation process to seek public and stakeholder input into the possibility of establishing a management framework for offshore non-fuel minerals. Natural Resources Canada's (NRCan's) Offshore Mineral Management Initiative (OMMI) is now being conducted with the intent of making recommendations to Cabinet on the development and management of offshore minerals in Canada. An intergovernmental task force, with representation from federal and provincial mining departments, is to investigate the desire and need for the development of an offshore minerals mining regime.

Aggregate (sand and gravel) is the least valuable mineral by volume, but is required in huge amounts in the construction industry. The continental margin of eastern Canada contains vast reserves on the outer banks of the Scotian Shelf, *e.g.*, Browns, Middle, Misaine and Banquereau Banks. The most likely areas of initial interest are placer gold mining in nearshore Nova Scotia and large-scale aggregate extraction from the eastern Scotian Shelf and the Bay of Fundy. The main market for Atlantic Canadian aggregates is the northeast US where a high future demand is anticipated for sand and gravel for major road rebuilding from New England to Florida over the next 10-15 years. Domestic markets also exist in Atlantic Canada.

3.5.2 Nature of Uses and Effects

One model scenario has been developed for NRCan based on large-scale extraction of offshore aggregates on the eastern Scotia Shelf using a large vessel and hydraulic suction dredge for which depths of excavation can be controlled. This scenario involves exports to the US. NRCan reported that technology exists to mitigate turbidity impacts with silt curtains, dredge-head hoods, etc. Much of the aggregate on the outer banks is reported to be free of silt and clay particles, having formed in a previous high-energy beach environment. Toxic sediments are not expected on the eastern Scotian Shelf. Despite possible changes in grain size, a 3-to-5 year recovery of the benthic community is expected and fisheries

interference is considered season specific. Interference with navigation could be negotiated. NRCan reported that potential long-term impacts of habitat removal could be mitigated by only partial removal (1%) of the sediments leaving the seabed with similar textural characteristics. NRCan also suggests that limiting extraction depth and time could mitigate changes to seabed relief.

An area exists on Eastern Shoal on Banquereau (120 km x 15 km x 30 m deep) consisting of >95% silica sand. The scenario involved extraction of 1.6 million tonnes/year (increasing to 10 million tonnes/year) with transportation to a shallow nearshore bay on the eastern shore of Nova Scotia for quick dumping. Smaller dredges could then load this material into barges or bulk carriers for export to the US. Canso has been suggested as a possible transport facility. This scenario may be uneconomic without the intermediate step of a shallow Nova Scotian bay for trans-shipment facility location.

Unlike the UK North Sea marine aggregate extraction industry which mainly extracts material using vertical penetration of the seabed, the development of an aggregate industry on the eastern Scotian Shelf would likely see broad horizontal extraction of the seabed, rather than vertical penetration. Dredge operations could have serious effects on fish habitat and raise other ecosystem concerns. Other countries are restricting proposals of this type. Potential opposition to the OMMI is expected from Scotian Shelf fisheries interests. The OMMI highlights the importance for geo-referenced information regarding sensitive areas, species distributions and mineral resources. If OMMI goes ahead, DFO will be asked: Where are the living resources? Where are the sensitive areas? Where should aggregates not be extracted? Environmental impact assessment requirements under the *Canadian Environmental Assessment Act* will be substantial under this development process. There are implications for fish habitat impacts and section 35 authorizations under the *Fisheries Act*. Ocean dumping permitting under CEPA regulations may be required by Environment Canada if dredged material is dumped in Canadian waters. Coast Guard *Navigable Waters Protection Act* permits would likely be needed.

3.5.3 Public Consultations and Potential Governance Framework

Public consultations will be carried out using 'virtual workshop' Internet technology. In areas where Internet access is not a viable alternative, these consultations will be complemented with paper versions of the information. This process will attempt to develop consensus on the risks and opportunities of offshore mineral development and will determine whether or not to proceed with developing an offshore minerals management regime. It will be an open process with no pre-set outcomes.

An important issue is the question of federal/provincial jurisdiction, as ownership of submerged lands remains unresolved. The *Oceans Act* clearly states that federal jurisdiction is not shared with the provinces and DFO jurisdiction applies in the offshore where no other legislation applies. This issue remains untested in the courts and clearly is one of the more controversial aspects for consideration at the ministerial level. Options discussed for regulatory regimes include a federal statute and mirror legislation not unlike the CNSOPB. Joint federal/provincial boards or committees may be proposed. The Aboriginal position on offshore mining is unknown/unpredictable in light of the Marshall decision. Potential jurisdictional overlap is shown by Nova Scotia's *Energy and Mineral Resources Conservation Act*, which states that:

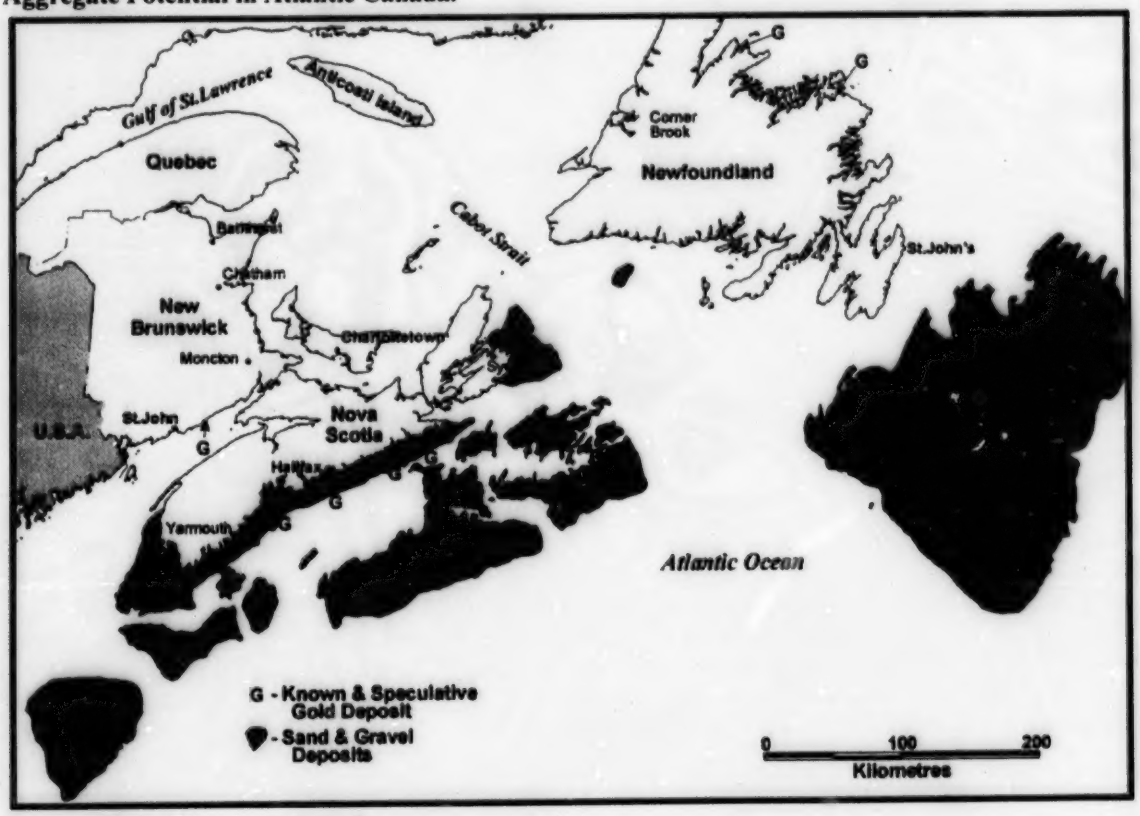
> *This Act applies to all Nova Scotia lands, which means the land mass of Nova Scotia including Sable Island, and includes the seabed and subsoil off the shore of the land mass of Nova Scotia, the seabed and subsoil of the continental shelf and slope and the seabed and subsoil seaward from the continental shelf and slope to the limit of exploitability.*

NRCan's view is that a large, expensive regulatory mechanism such as CNSOPB is not desirable and that there could be one Atlantic Canadian regulatory mechanism. NRCan plans to lead in any potential management regime for offshore minerals, with a commitment to sustainable development and intent to collaborate with DFO and work according to the *Oceans Act*.

3.5.4 Ecosystem Issues

The development of an offshore aggregate industry on the eastern Scotian Shelf will result in ecosystem impacts and localized habitat destruction/removal. In order to assess the potential impacts, a comparative analysis should be conducted of the relative physical effects on benthic habitat from all ocean uses, *e.g.*, suction dredging, submarine cable laying, oil and gas facility construction, and mobile fishing gear disturbance (*e.g.*, hydraulic dredges, scallop dredges, otter trawls). A compilation of geo-referenced baseline information regarding sensitive areas and living and mineral resource spatial distribution would be useful for ocean-use planning. Furthermore, an investigation of multiple ocean use issues and ecosystem impacts of North Sea aggregate extraction may provide predictions of likely impacts in Atlantic Canada. An ICES Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem is engaged in such an effort with Canadian participation.

Aggregate Potential in Atlantic Canada.



Source: Natural Resources Canada.

3.6 CUMULATIVE ECOSYSTEM EFFECTS

A cumulative effect may be defined as "a change to the environment caused by an action in combination with other past, present and future human actions,"[15] or as "environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out."[16] Cumulative effects are important when the effects of an ocean use are persistent over time (*i.e.*, difficult to reverse), such as pollution with heavy metals and some pesticides or large-scale destruction of habitat, or when activities are in close proximity in time and space. When environmental effects of activities are considered separately they may all be below the threshold levels that cause impacts. Some effects, although thought to be transitory or of minor importance on the scale of a single source (*e.g.*, an otter trawler, an oil well, or a seismic survey) may prove to be of serious concern when combined.

When all sources (*i.e.*, noise, pollutants, and physical alteration) are taken into account, do the collective effects give grounds for additional concerns? If activities and sources are considered collectively in time and space, their additive and/or synergistic effects—*i.e.*, cumulative effects—may cause serious impacts. Currently, there is no process or mechanism to take into account the cumulative effects of human activity on the marine environment. The concept has been addressed in the *Canadian Environmental Assessment Act (CEAA)* and in policies associated with fish habitat provisions of the *Fisheries Act*. However, these capture only physical works and undertakings and certain activities, as in the case of *CEAA*[17], or activities that are accompanied by requests for review or authorization for harm of fish habitat. To date, there is no operational mechanism to capture the effects of all activities, spatially or temporally. There are three main problems. First is the lack of established ecosystem quality indicators with target levels to work toward. In an attempt to address this, integrated ocean management plans will require ecosystem objectives/indicators and target levels to achieve for the combined effects of all activities. Secondly, there is a need to capture all activities, both temporally and spatially. Currently, there is no existing body that monitors all activities, so we cannot assess them against target levels. Thirdly, monitoring of activities is difficult and compliance with rules is hard to enforce—*e.g.*, who is to blame for exceeding a regulated target level, all collectively or the last one in? The solution may lie in a collaborative, integrated management approach.

A collaborative administrative vehicle may be required to provide an oversight function with respect to cumulative ecosystem impacts, with a defined agency mandate to implement an action plan to reduce overall impacts to within target levels. Such an institutional body could be mandated to monitor and quantify the cumulative quantities of oil, noise levels and contaminant load entering the eastern Scotian Shelf annually. For example, by using a cross-sectoral inventory of activities for spatial and temporal coordination, this body could act as "gatekeeper" in situations such as in the summer of 2001 when the Department of National Defense, the Geological Survey of Canada, and nine seismic survey programs were permitted, each under separate permitting processes, to generate noise on the Scotian Shelf but without cross-linking conditions. An overview of potential cumulative effects of future development activities on the eastern Scotian Shelf is needed. Future applications for development could include a thorough evaluation of the potential cumulative effects of the project in question, in conjunction with past, present and foreseeable projects and stresses on the marine environment. An Environmental Studies Research Funds (ESRF) workshop recommended that DFO lead future regional cumulative effects

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[15] Hegmann, G., et al. 1999. Cumulative Effects Assessment Practitioners Guide. Prepared by Axys Environmental Consulting Ltd. and the CEA Working Group for the Canadian Environmental Assessment Agency.

[16] Section 16(a), *Canadian Environmental Assessment Act*.

[17] Although *CEAA* does not cover all activities, it requires that all federal environmental assessments include a consideration of cumulative environmental effects. Despite this legislated requirement, federal environmental assessments to date have not given close attention to cumulative effects.

initiatives and that DFO take the lead in sponsoring a multi-stakeholder process to develop a viable approach to regional cumulative effects assessment.[18]

4.0 SUMMARY OF RECOMMENDATIONS

The following conclusions arise from this analysis of the present scope of conservation objectives of agencies regulating ocean uses and of the changes that will be required if the seven ecosystem issues proposed by the ESSIM Workshop were to be adopted as policy:

Fisheries

- There is a need to institutionalise an overview mechanism for science advice and fisheries management planning so that the operational requirements for meeting defined ecosystem conservation objectives are established at a level above that of planning for individual fisheries. (These needs could be met by institutional arrangements at the inter-sector level (see below); this recommendation does not imply that separate fisheries sector arrangements are essential.)
- The IFMP process provides a suitable vehicle for the application of ecosystem conservation measures. The deficiencies identified in the initial IFMPs are being addressed and it is essential that these improved guidelines be implemented successfully.
- The systematic introduction of ecosystem considerations to fishery management requires that the present obscurity of management planning be corrected. A broad community of interest must have ready access to current information on all species plans. A communications strategy with web-based access as a central element presents a practical way of supporting an integrated regional fishery management process.
- The role of FRCC needs to be addressed due to the potential conflict with DFO on groundfish plan development as the IFMP planning process evolves to include ecosystem objectives.

Oil and Gas

- To take account of the growth of scientific knowledge and understanding of the impacts of noise in the marine environment, there is a need to continue program-specific environmental assessments for all seismic operations in conjunction with class assessments that are updated every 5–7 years. Adoption of measures to minimize the cumulative effects of seismic surveying, such as spatial, seasonal and temporal adjustments in surveys and reduction or elimination of multiple surveying of areas is likely to be necessary.
- The assumption in the Generic Assessment for Exploration Drilling that the effects of drilling within the study area are the same regardless of where drilling occurs may not be appropriate in the context of ecosystem objectives to maintain diversity of ecosystem types and species diversity. In particular, drilling on the continental slope, where the ecosystem may be more fragile, should be assessed differently from drilling on the shelf.
- The Valued Ecosystem Components methodology provides an adaptable basis for identifying key issues but present definitions will need to be expanded to address the broader objectives proposed under an ecosystem approach, as well as to include evolving public concerns related to social, cultural and economic uses of the oceans.
- The proposed ecosystem objectives would require Offshore Waste Treatment Guidelines that take a more holistic approach to discharge management. An important element will be to give consideration

[18] Hatch Associates Limited and Griffiths Muecke Associates. 2000. Workshop on Cumulative Environmental Effects Assessment and Monitoring on the Grand Banks and Scotian Shelf. Environmental Studies Research Funds Report, ESRF137, Ottawa.

to the aggregate and cumulative effects of wastes discharged, as the number of installations increases. The maintenance of marine environmental quality will require improved regulation of contaminant content of waste discharges as new knowledge is acquired and the guidelines may need to be updated more often than every five years to keep pace with changes in drilling fluids. The potential for a reverse onus policy in the development of new drilling fluids is raised by application of the precautionary approach. Environmental Effects Monitoring programs need to include pelagic as well as benthic components and science-based regulations on depths at which wastes may be discharged.

- DFO should establish a formal internal review process, possibly including RAP, to provide scientific review of future proposals and assessments of the effects of oil and gas on the marine environment. As the CNSOPB leasing process provides no prior opportunity for DFO review and only a 120-day period for comment during the bidding process, advance notice under the DFO-CNSOPB MOU may need to be considered. More scientific involvement also is needed in the review of Offshore Waste Treatment Guidelines and EEM programs.

Marine Transportation

- Increased commercial shipping activity in the eastern Scotian Shelf area raises concerns of ship-source pollution (*e.g.*, oil, oily water and ballast water) and associated impacts (*e.g.*, noise) on marine life and environmental quality. To address these issues, improved strategies are required to promote compliance by the shipping industry with national and international regulations, guidelines and standards.
- Interdepartmental coordination on ship-source pollution and inputs needs to be continued through existing departmental MOUs and arrangements for surveillance, monitoring and response.
- A comprehensive database for analysis and mapping of shipping patterns is needed to facilitate oceans management and decision-making (*e.g.*, ballast water issues).

Maritime Defence Operations

- Certain maritime defence operations, particularly those involving explosives and sonar, warrant serious consideration in terms of potential impacts on ecosystem diversity, species diversity and marine environmental quality.
- Increased engagement of DND and the Maritime Forces is required at the policy, operational and research levels (*e.g.*, noise impacts with DND's Defence Research Establishment Atlantic) to address a range of oceans management and ecosystem issues. The Maritime Forces must be considered as a user of ocean ecosystems, as well as an important partner for the effective implementation of the *Oceans Act* (*e.g.*, surveillance and patrol).

Ocean Mining (Potential)

- A comparative analysis is needed of relative benthic impacts from all ocean uses in order to put aggregate mining in context.
- Geo-referenced baseline information on mineral resource distributions is needed.
- Predictions of potential impacts in Atlantic Canada would benefit from an examination of the multiple use issues and ecosystem impacts of the North Sea aggregate industry.

Cumulative Ecosystem Impacts

- There is a need for a responsible administrative vehicle with an oversight and "gatekeeper" function for cumulative ecosystem impacts and a mandate to take action.

- An overview of potential cumulative effects of future development activities on the eastern Scotian Shelf is needed.
- Applications for development should include a thorough evaluation of potential cumulative effects of the project in question, in conjunction with past, present and foreseeable projects and stresses on the marine environment.
- Geo-referenced baseline data on sensitive and important areas and living resource distributions are needed.

The sum total of current management plans, regulations and policies for the various sectors do not fully address the ecosystem objectives adopted by the ESSIM Workshop of June 2000. The present sectoral approach cannot ensure that human interactions will not reduce the productivity of resources or cause lasting modifications to the functioning of ecosystems. An integrated approach is required if this set of potential ecosystem objectives is to be satisfactorily addressed.

5.0 ACKNOWLEDGEMENTS

The authors acknowledge the helpful comments and suggestions on earlier versions of this manuscript by Chris Annand (DFO), Mike Balaban (Transport Canada), LCdr Steve Bloom (DND), Valerie Bradshaw (DFO), Gloria Chao (Dalhousie University), Peter Cranford (DFO), André d'Entremont (CNSOPB), Gordon Fader (NRCan), Paul Keizer (DFO), Ken Lee (DFO), Bob O'Boyle (DFO), Andy Parker (CNSOPB), Greg Peacock (DFO), Kyle Penney (DND), Bob Rutherford (DFO), Reg Sweeney (DFO), Eric Theriault (CNSOPB), and Deidre Vance (NRCan).

6.0 REFERENCES

Beanlands, G.E. and P.N. Duinker. 1983. An ecological framework for environmental impact assessment in Canada. Halifax, NS. Institute for Resource and Environmental Studies, Dalhousie University and Federal Environmental Assessment Review Office.

DFO, 1997. 1996 Integrated Fisheries Management Plans (IFMP) Final Audit Report – October 1997. Unpublished internal report, Fisheries Management, Ottawa, 71pp.

Gislason, H., M. Sinclair, K. Sainsbury, and R. O'Boyle. 2000. Symposium overview: incorporating ecosystem objectives within fisheries management. *ICES Journal of Marine Science*, **57**: 468–475.

Gordon, D.C. Jr., P.J. Cranford, C.G. Hannah, J.W. Loder, T.G. Milligan, D.K. Muschenheim and Y. Shen. 2000. Modelling the transport and effects on scallops of water-based drilling mud from potential hydrocarbon exploration on Georges Bank. *Can. Tech. Rep. Fish. Aquatic. Sci.* 2317. 116 pp.

LGL Ltd., 2000. Assessment of Noise Issues Relevant to Key Cetacean Species (Northern Bottlenose and Sperm Whales) in the Sable Gully Area of Interest. LGL Report TA2446-2.

LGL Ltd., 1999. Environmental Assessment of Exploration Drilling off Nova Scotia. p. 280 + iv Appendices.

LGL Ltd., 1998. Environmental Assessment of Seismic Exploration on the Scotian Shelf. p. 181 + iv Appendices.

MARLANT Environmental Assessment Guide. 1997. Formation Environment. Version 1, 6 December 1997. Halifax, Maritime Forces Atlantic.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M-N. Jenner, J. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch and K. McCabe. 2000. Marine Seismic Surveys: A Study of Environmental Implications. *Australian Petroleum Production and Exploration Association Journal,* **40**: 692–705.

O'Boyle, R. (Chair and Editor) 2000. Proceedings of a Workshop on the Ecosystem Considerations for the Eastern Scotian Shelf Integrated Management (ESSIM) Area. CSAS Proceedings Document 2000/14, 92 pp.

RAP, 1998. Proceedings of the Fisheries Management Studies Working Group, 23–25 February 1998, Gulf Fisheries Centre, Moncton, New Brunswick. Can. Stock Assess. Proc. Ser. 98/09, 38pp.

Richardson, J.W., C.R. Greene Jr., C.I. Malme and D.H. Thomson, 1995. Marine Mammals and Noise. San Diego: Academic Press.

ANNEX 1 – List of Acronyms

AOI	Area of Interest
AOR	Area of Operational Responsibility
AOSC	Atlantic Operations Sub-Committee
CANMARNET	Canadian Maritime Network
CCG	Canadian Coast Guard
CEAA	Canadian Environmental Assessment Act
CEPA	Canadian Environmental Protection Act
CMAC	Canadian Marine Advisory Council
CNOPB	Canada-Newfoundland Offshore Petroleum Board
CNSOPB	Canada-Nova Scotia Offshore Petroleum Board
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
DND	Department of National Defence
EA	Environmental Assessment
EEM	Environmental Effects Monitoring
EES	Environmental Emergencies Section (Environment Canada)
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
ESSIM	Eastern Scotian Shelf Integrated Management
FRCC	Fisheries Resource Conservation Council
ICCAT	International Commission on the Conservation of Atlantic Tuna
ICES/SCOR	International Council for the Exploration of the Sea/ Scientific Committee on Oceanic Research
ICMO	Interdepartmental Concept of Maritime Operations
IFMP	Integrated Fishery Management Plan
IMO	International Maritime Organisation
IPCRC	Interdepartmental Program Coordination and Review Committee
JPA	Joint Project Agreement
MARCOM	Maritime Command
MARCORD	Maritime Command Orders
MARCOT	Maritime Command Operational Training
MARLANT	Maritime Forces Atlantic
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships
MCM	Mine Counter-Measures
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MSAB	Maritimes Seacoast Advisory Board
NAFO	Northwest Atlantic Fisheries Organisation
NEB	National Energy Board
NRCan	Natural Resources Canada
OMMI	Offshore Minerals Management Initiative
PCB	Polychlorinated Biphenyls
ppm	Parts Per Million
RAP	Regional Advisory Process (DFO)
RCMP	Royal Canadian Mounted Police
REET	Regional Environmental Emergencies Team
RMP	Recognized Maritime Picture
ROC	Regional Operations Centre (CCG)

SAR	Search and Rescue
SEBS	Ships' Environmental Baseline Study
SEEMAG	Sable Offshore Energy Environmental Effects Monitoring Advisory Group
SMGL	Small Mesh Gear Line
SOEI	Sable Offshore Energy Incorporated
SOEP	Sable Offshore Energy Project
SOLAS 74	International Convention for the Safety of Life at Sea
TAC	Total Allowable Catch
TCF	Trillion Cubic Feet
VDS	Variable Depth Sonars
VEC	Valued Ecosystem Component